TEST REPORT

No. I18D00233-SRD04

For

Client: Shanghai Sunmi Technology Co.,Ltd.

Production: Wireless data POS System

Model Name: T5921

Brand Name: SUNMI

FCC ID : 2AH25T5921

Hardware Version: QP1665_MB_PCB_V1

Software Version: zqp1665_V002_181121

Issued date: 2020-01-19

NOTE

1. The test results in this test report relate only to the devices specified in this report.
2. This report shall not be reproduced except in full without the written approval of East China Institute of Telecommunications.
3. ANSI/TIA-603-E and KDB 971168 D01 has not been approved by A2LA.
4. For the test results, the uncertainty of measurement is not taken into account when judging the compliance with specification, and the results of measurement or the average value of measurement results are taken as the criterion of the compliance with specification directly.

Test Laboratory:
East China Institute of Telecommunications
Add: Building 4, No. 766, Jingang Road, Pudong, Shanghai, P.R. China 201206
Tel: +86 21 63843300
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Revision Version

Report Number	Revision	Date	Memo
I18D00233-SRD04	00	2019-01-17	Initial creation of test report
I18D00233-SRD04	01	2020-01-19	Second creation of test report

CONTENTS

1. TEST LABORATORY 6
1.1. TESTING LOCATION 6
1.2. TESTING ENVIRONMENT 6
1.3. PROJECT DATA 6
1.4. SIGNATURE 6
2. CLIENT INFORMATION 7
2.1. APPLICANT INFORMATION 7
2.2. MANUFACTURER INFORMATION 7
3. EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT (AE) 8
3.1. ABOUT EUT 8
3.2. INTERNAL IDENTIFICATION OF EUT USED DURING THE TEST 8
3.3. INTERNAL IDENTIFICATION OF AE USED DURING THE TEST 8
4. REFERENCE DOCUMENTS 9
4.1. DOCUMENTS SUPPLIED BY APPLICANT 9
4.2. REFERENCE DOCUMENTS FOR TESTING 9
5. TEST RESULTS 10
5.1. SUMMARY OF TEST RESULTS 10
5.2. STATEMENTS 11
6. TEST EQUIPMENTS UTILIZED 12
6.1. CONDUCTED TEST SYSTEM 12
6.2. RADIATED EMISSION TEST SYSTEM 12
7. MEASUREMENT UNCERTAINTY 14
8. TEST ENVIRONMENT 15
ANNEX A. DETAILED TEST RESULTS 16
ANNEX A.1. OUTPUT POWER 16

ANNEX A.2. PEAK-TO-AVERAGE POWER RATIO 19

ANNEX A.3. OCCUPIED BANDWIDTH 21

ANNEX A.4. -26DB EMISSION BANDWIDTH 35

ANNEX A.5. BAND EDGE AT ANTENNA TERMINALS 49

ANNEX A.6. FREQUENCY STABILITY.....57

ANNEX A.7. CONDUCTED SPURIOUS EMISSION 63

ANNEX A.8. RADIATED 81

ANNEX A. ACCREDITATION CERTIFICATE.....103

1. Test Laboratory

1.1. Testing Location

Company Name	East China Institute of Telecommunications
Address	Building 4, No. 766, Jingang Road, Pudong, Shanghai, P.R. China
Postal Code	201206
Telephone	+86 21 63843300
Fax	+86 21 63843301
FCC registration No	958356

1.2. Testing Environment

Normal Temperature	15℃-35℃
Relative Humidity	20%-75%

1.3. Project Data

Project Leader	Yu Anlu
Testing Start Date	2018-12-17
Testing End Date	2019-01-11

1.4. Signature

Liu Yan
(Prepared this test report)

Fan Songyan
(Reviewed this test report)

Zheng Zhongbin
(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name	Shanghai Sunmi Technology Co.,Ltd.
Address	Room 505, KIC Plaza, No.388 Song Hu Road, Yang Pu District, Shanghai, China
Telephone	18721763396
Postcode	200433

2.2. Manufacturer Information

Company Name	Shanghai Sunmi Technology Co.,Ltd.
Address	Room 505, KIC Plaza, No.388 Song Hu Road, Yang Pu District, Shanghai, China
Telephone	18721763396
Postcode	200433

3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Production	Wireless data POS System
Model name	T5921
FCC ID	2AH25T5921
GSM Frequency Band	GSM850/GSM900/GSM1800/GSM1900
UMTS Frequency Band	Band I/II/IV/V
CDMA Frequency Band	BC0/BC1
LTE Frequency Band	Band 2/4/7/17
Additional Communication Function	BT/BLE/2.4G WLAN 802.11 b/g/n20/n40/5G WLAN 802.11 a/n20/n40
Extreme Temperature	-30/+50℃
Nominal Voltage	7.6V
Extreme High Voltage	8.7V
Extreme Low Voltage	7V

Note: Photographs of EUT are shown in ANNEX A of this test report.

3.2. Internal Identification of EUT used during the test

EUT ID*	Model Name	SN or IMEI	HW Version	SW Version	Date of receipt
N01	T5921	/	QP1665_MB_PCB_V1	zqp1665_V002_181121	2018-12-13
N07	T5921	/	QP1665_MB_PCB_V1	zqp1665_V002_181121	2018-12-13

*EUT ID: is used to identify the test sample in the lab internally.

3.3. Internal Identification of AE used during the test

AE ID*	Description	Type	Manufacturer
AE1	RF cable	---	AE1

*AE ID: is used to identify the test sample in the lab internally.

4. Reference Documents

4.1. Documents supplied by applicant

All technical documents are supplied by the client or manufacturer, which is the basis of testing.

4.2. Reference Documents for testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part 24	PERSONAL COMMUNICATIONS SERVICES	2018-10-01
FCC Part 22	PUBLIC MOBILE SERVICES	2018-10-01
FCC Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS	2018-10-01
ANSI-TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2016
ANSI C63.26	American National Standard of Procedures for Compliance Testing of Licensed Transmitters Used in Licensed Radio	2015
KDB 971168 D01	Measurement Guidance for Certification of Licensed Digital Transmitters	v03r01

5. Test Results

5.1. Summary of Test Results

Measurement Items	Sub-clause of Part15C	Sub-clause of IC	Verdict
Output Power	2.1046/22.913(a)/ 24.232(c)	/	P
Peak-to-Average Ratio	24.232(d)	/	P
99%Occupied Bandwidth	2.1049(h)(i)/ 22.917(b)	/	P
-26dB Emission Bandwidth	22.917(b)/§24.238 (b)	/	P
Band Edge at antenna terminals	22.917(a)/24.238(a)	/	P
Frequency stability	2.1055/24.235	/	P
Conducted Spurious mission	2.1053/22.917(a)/ 24.238(a)	/	P
Emission Limit	2.1051/22.917/24. 238/22.913/24.232	/	P

Note: please refer to Annex A in this test report for the detailed test results.

The following terms are used in the above table.

P	Pass, the EUT complies with the essential requirements in the standard.
NP	Not Perform, the test was not performed by ECIT.
NA	Not Applicable, the test was not applicable.
F	Fail, the EUT does not comply with the essential requirements in the standard.

Test Conditions

Tnom	Normal Temperature
Tmin	Low Temperature
Tmax	High Temperature
Vnom	Normal Voltage
Vmin	Low Voltage
Vmax	High Voltage
Hnom	Norm Humidity
Anom	Norm Air Pressure

For this report, all the test case listed above are tested under Normal Temperature and Normal Voltage, and also under norm humidity, the specific conditions as following:

Temperature	Tnom	25℃
Voltage	Vnom	7.6V
Humidity	Hnom	48%
Air Pressure	Anom	1010hPa

5.2. Statements

The T5921, supporting GPRS/EDGE/WCDMA/CDMA/LTE/BT/BLE/WLAN/NFC, manufactured by Shanghai Sunmi Technology Co.,Ltd., is an initial product for testing.

ECIT only performed test cases which identified with P/NP/NA/F results in Annex A.

ECIT has verified that the compliance of the tested device specified in section 3 of this test report is successfully evaluated according to the procedure and test methods as defined in type certification requirement listed in section 4 of this test report.

6. Test Equipments Utilized

6.1. Conducted Test System

No.	Name	Type	SN	Manufacture	Calibration date	Cal.interval
1	Spectrum Analyzer	FSQ26	101096	R&S	2018-05-11	1 year
2	Universal Radio Communicatio	CMU200	123124	R&S	2018-05-11	1 year
3	DC Power Supply	ZUP60-14	LOC-220Z006 -0007	TDL-Lambda	2018-05-11	1 year

6.2. Radiated Emission Test System

The test equipment and ancillaries used are as follows.

No.	Equipment	Model	Serial Number	Manufacturer	Calibration date	Cal.interval
1	Universal Radio Communication Tester	CMU200	123123	R&S	2018-05-11	1 year
2	EMI Test Receiver	ESU40	100307	R&S	2018-05-11	1 year
3	TRILOG Broadband Antenna	VULB9163	VULB9163-515	Schwarzbeck	2017-02-25	3 years
4	Double-ridged Waveguide Antenna	ETS-3117	00135890	ETS	2017-01-11	3 years
5	2-Line V-Network	ENV216	101380	R&S	2018-05-11	1 year
6	Substitution Antenna	ETS-3117	00135890	ETS	2017-01-11	3 years

7	RF Signal Generator	SMF100A	102314	R&S	2018-05-11	1 year
8	Substitution Antenna	VUBA9117	9117-266	Schwarzbeck	2017-11-18	3 years
9	Amplifier	SCU08	10146	R&S	2018-05-11	1 year

Climate chamber

No.	Equipment	Model	Serial Number	Manufacturer	Calibration date	Cal.interval
1	Climate chamber	SH-641	92012011	ESPEC	2017-12-25	2 years

7. Measurement Uncertainty

Measurement uncertainty for all the testing in this report are within the limit specified in ECIT documents . The detailed measurement uncertainty is defined in ECIT documents.

Measurement Items	Range	Confidence Level	Calculated Uncertainty
Maximum Peak Output Power	30MHz-3600MHz	95%	±0.544dB
EBW and VBW	30MHz-3600MHz	95%	±62.04Hz
Transmitter Spurious Emission-Conducted	30MHz-2GHz	95%	±0.90dB
Transmitter Spurious Emission-Conducted	2GHz-3.6GHz	95%	±0.88dB
Transmitter Spurious Emission-Conducted	3.6GHz-8GHz	95%	±0.96dB
Transmitter Spurious Emission-Conducted	8GHz-20GHz	95%	±0.94dB
Transmitter Spurious Emission-Radiated	9KHz-30MHz	95%	±5.66dB
Transmitter Spurious Emission-Radiated	30MHz-1000MHz	95%	±4.98dB
Transmitter Spurious Emission-Radiated	1000MHz -18000MHz	95%	±5.06dB
Transmitter Spurious Emission-Radiated	18000MHz -40000MHz	95%	±5.20dB
Frequency stability	1MHz-16GHz	95%	±62.04Hz

8. Test Environment

Shielding Room1 (6.0 meters×3.0 meters×2.7 meters) did not exceed following limits along the conducted RF performance testing:

Temperature	Min. = 15 ℃, Max. = 35 ℃
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Ground system resistance	< 0.5 Ω

Control room did not exceed following limits along the EMC testing:

Temperature	Min. = 15 ℃, Max. = 35 ℃
Relative humidity	Min. =25 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 10 kΩ
Ground system resistance	< 0.5 Ω

Fully-anechoic chamber1 (6.9 meters×10.9 meters×5.4 meters) did not exceed following limits along the EMC testing:

Temperature	Min. = 15 ℃, Max. = 35 ℃
Relative humidity	Min. = 25 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 10 kΩ
Ground system resistance	< 0.5 Ω
VSWR	Between 0 and 6 dB, from 1GHz to 18GHz
Site Attenuation Deviation	Between -4 and 4 dB,30MHz to 1GHz
Uniformity of field strength	Between 0 and 6 dB, from 80MHz to 3000 MHz

ANNEX A. Detailed Test Results

ANNEX A.1. OUTPUT POWER

A.1.1. Summary

During the process of testing, the EUT was controlled Rhode & Schwarz Digital Radio. Communication tester (CMU-200) to ensure max power transmission and proper modulation.
This result contains peak output power and EIRP measurements for the EUT. In all cases, output power is within the specified limits.

A.1.1. Summary

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This result contains peak output power and EIRP measurements for the EUT. In all cases, output power is within the specified limits.

A.1.2. Conducted

A.1.2.1. Method of Measurements

Method of measurements please refer to KDB971168 D01 v03 clause 5.
The EUT was set up for the max output power with pseudo random data modulation.
The power was measured with Rhode & Schwarz Spectrum Analyzer FSQ(peak).
These measurements were done at 3 frequencies, 1850.2 MHz, 1880.0MHz and 1909.8MHz for PCS1900 band; 824.2MHz, 836.6MHz and 848.8MHz for GSM850 band. (bottom, middle and top of operational frequency range).
These measurements were done at 3 frequencies, 1852.4 MHz, 1880.0MHz and 1907.6MHz for WCDMA Band II; 826.4MHz, 836.6MHz and 846.6MHz for WCDMA Band V. (bottom, middle and top of operational frequency range).

A.1.2.2 Test procedures:

1. The transmitter output port was connected to base station.
2. Set the EUT at maximum power through base station.
3. Select lowest, middle, and highest channels for each band and different modulation.
4. Measure the maximum burst average power for GSM and maximum average power for other modulation signal.

A.1.2.3 Limit:

22.A13(a) Mobile stations are limited to 7watts.
24.232(c) Mobile and portable stations are limited to 2 watts.

A.1.2.4 Test Procedure:

The transmitter output power was connected to calibrated attenuator, the other end of which was connected to signal analyzer. Transmitter output power was read off the power in dBm. The power outputs at the transmitter antenna port was determined by adding the value of attenuator to the signal analyzer reading.

A.1.2.5 GSM Test Condition:

RBW	VBW	Sweep time	Span
3MHz	10MHz	Auto	50MHz

A.1.2.6 WCDMA Test Condition:

RBW	VBW	Sweep time	Span
10MHz	30MHz	Auto	50MHz

A.1.2.7 Measurement results:

GPRS 850 (GMSK 1 Slot)		
Channel/fc(MHz)	Peak power (dBm)	AV power (dBm)
Mid 189/836.4	31.53	31.24
Low 128/824.2	31.41	31.05
High 251/848.8	31.68	31.34
EDGE 850 (8PSK 1 Slot)		
Channel/fc(MHz)	Peak power (dBm)	AV power (dBm)
Mid 189/836.4	29.24	26.04
Low 128/824.2	29.62	26.23
High 251/848.8	29.51	26.15

GPRS 1900 (GMSK 1 Slot)		
Channel/fc(MHz)	Peak power (dBm)	AV power (dBm)
Mid 661/1880	27.73	27.14
Low 512/1850.2	27.86	27.25
High 810/1909.8	28.14	27.60
EDGE 1900 (8PSK 1 Slot)		
Channel/fc(MHz)	Peak power (dBm)	AV power (dBm)
Mid 661/1880	27.14	24.02
Low 512/1850.2	27.43	24.15

High 810/1909.8	27.67	24.33

WCDMA II		
Channel/fc(MHz)	Peak power (dBm)	AV power (dBm)
Mid 9400 /1880	25.69	22.84
Low 9262/1852.4	25.87	22.97
High 9538/1907.6	25.73	22.86
WCDMA BAND IV		
Channel/fc(MHz)	Peak power (dBm)	AV power (dBm)
Mid 1413 /1732.6	25.61	22.92
Low 1312/1712.4	25.47	22.88
High 1513/1752.6	25.69	22.96
WCDMA BAND V		
Channel/fc(MHz)	Peak power (dBm)	AV power (dBm)
Mid 4183/836.6	26.85	23.34
Low 4132/826.4	26.71	23.26
High 4233/846.6	26.80	23.28

Conclusion: PASS

ANNEX A.2. Peak-to-Average Power Ratio

Method of test measurements please refer to KDB971168 D01 v03 clause 5.7.

A.2.1 PAPR Limit

The peak-to-average power ratio (PAPR) of the transmission may not exceed 13dB

A.2.2 Test procedures

1. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
2.
   1) Select the spectrum analyzer CCDF function.
   2) Set RBW⩾signal's occupied bandwidth.
   3) Set the number of counts to a value that stabilizes the measured CCDF cure;
   4) Sweep time ⩾ 1s.
3. Record the maximum PAPR level associated with a probability of 0.1%.

A.2.3 Test results:

GPRS850			
Channel	128	189	251
Frequency (MHz)	824.2	836.4	848.8
PAPR(dB)	8.45	8.31	8.54
EDGE850			
Channel	128	189	251
Frequency (MHz)	824.2	836.4	848.8
PAPR(dB)	8.71	8.62	8.54

GPRS1900			
Channel	512	661	810
Frequency (MHz)	1850.2	1880	1909.8
PAPR(dB)	8.59	8.61	8.37
EDGE1900			
Channel	512	661	810
Frequency (MHz)	1850.2	1880	1909.8
PAPR(dB)	8.75	8.54	8.41

WCDMA Band II			
Channel	9262	9400	9538
Frequency (MHz)	1852.4	1880	1907.6
PAPR(dB)	4.62	4.62	5.29
WCDMA Band IV			
Channel	1312	1413	1513
Frequency (MHz)	1712.4	1732.6	1752.6
PAPR(dB)	4.65	4.62	4.58
WCDMA Band V			
Channel	4132	4183	4233
Frequency (MHz)	826.4	836.4	846.6
PAPR(dB)	4.13	4.04	4.04

Conclusion: PASS

ANNEX A.3. Occupied Bandwidth

Method of test please refer to KDB971168 D01 v03 clause 4.0.

A.3.1. Occupied Bandwidth

Similar to conducted emissions; occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of GSM850, PCS1900, WCDMA BANDII and WCDMA BANDV.

A.3.2 Test Procedure:

1. The EUT output RF connector was connected with a short cable to the signal analyzer.
2. RBW was set to about 1% of emission BW, VBW >= 3 times RBW,.
3. 99% bandwidth were measured, the occupied bandwidth is delta frequency between the two points where the display line intersects the signal trace.

A.3.3 Test result:

GPRS850		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(KHz)
Mid 189	836.4	246.795
Low 128	824.2	240.385
High 251	848.8	243.59
EDGE850		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(KHz)
Mid 189	836.4	246.795
Low 128	824.2	246.795
High 251	848.8	245.192

Conclusion: PASS

GPRS 850

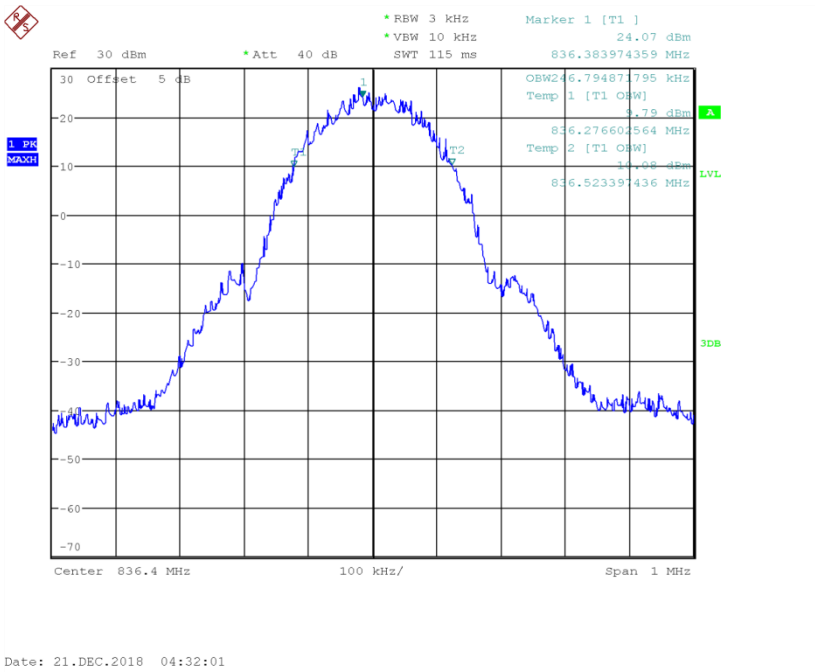

Fig.1 **Channel 189-Occupied Bandwidth (99%)**

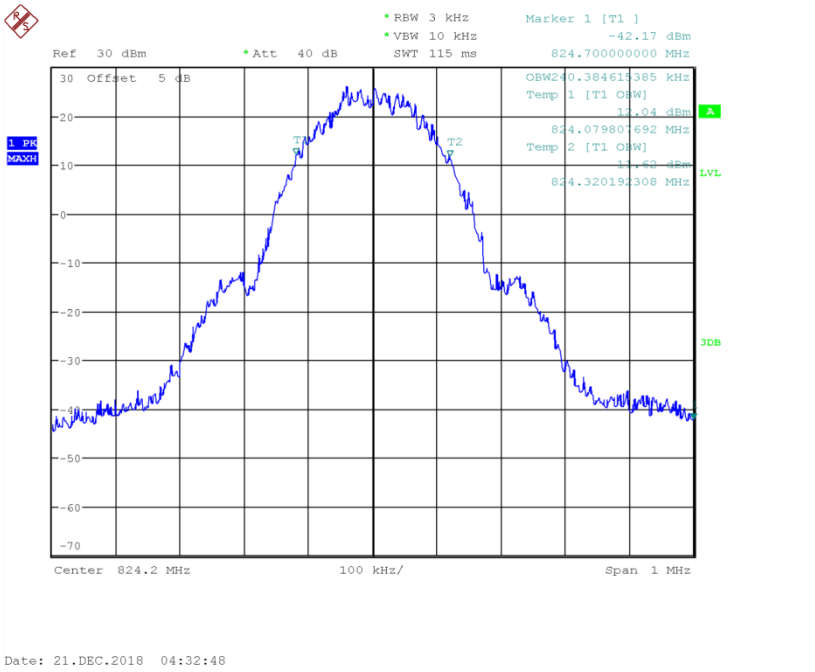

Fig.2 **Channel 128-Occupied Bandwidth (99%)**

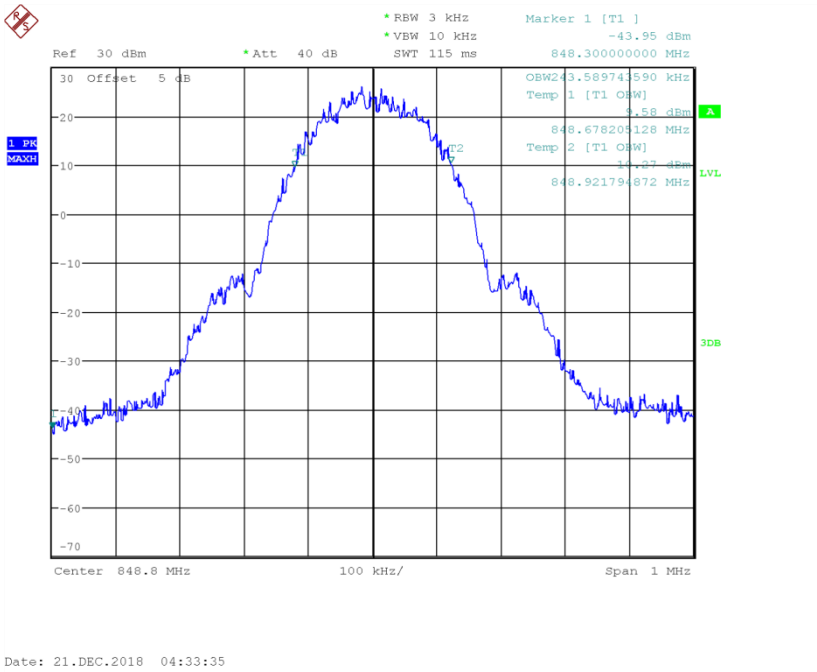

Fig.3 **Channel 251-Occupied Bandwidth (99%)**

EDGE 850

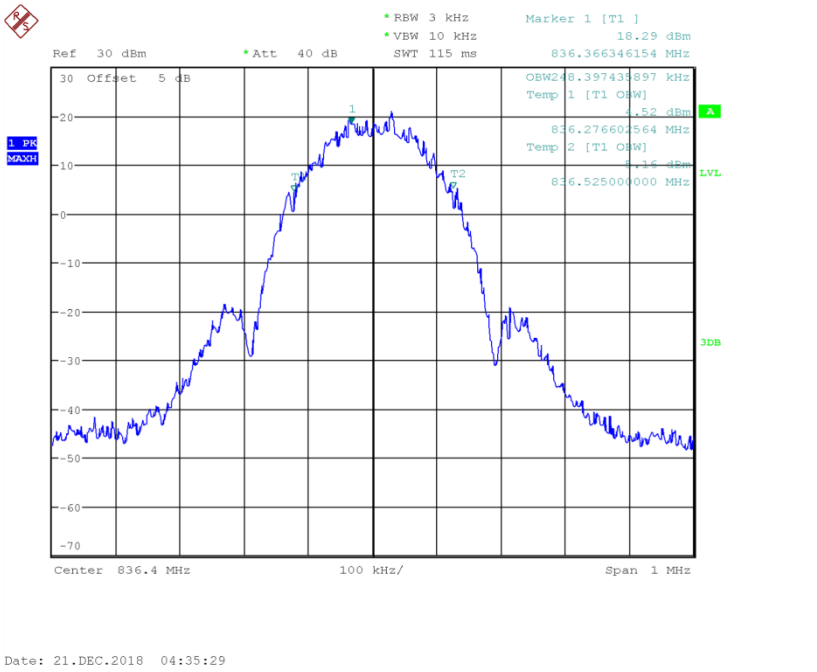

Fig.4 **Channel 189-Occupied Bandwidth (99%)**

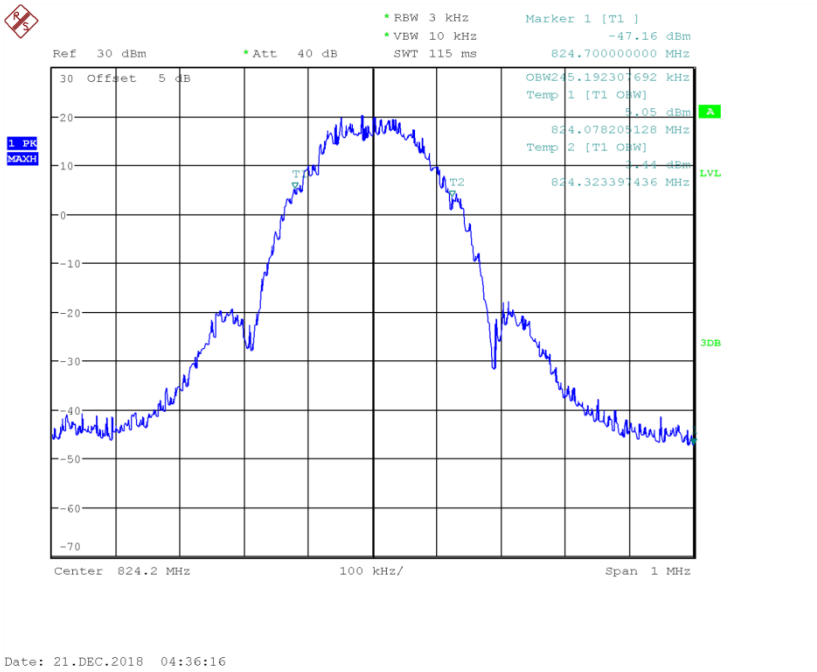

Fig.5 **Channel 128-Occupied Bandwidth (99%)**

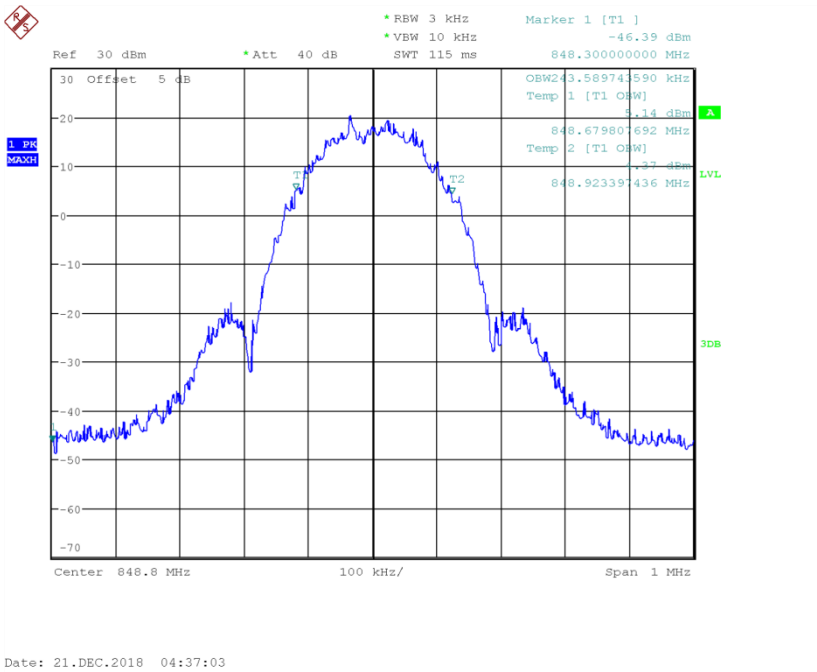

Fig.6 **Channel 251-Occupied Bandwidth (99%)**

GPRS1900		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(KHz)
Mid 661	1880	248.397
Low 512	1850.2	246.795
High 810	1909.8	250.000
EDGE1900		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(KHz)
Mid 661	1880	241.987
Low 512	1850.2	246.795
High 810	1909.8	246.795

Conclusion: PASS

GPRS 1900

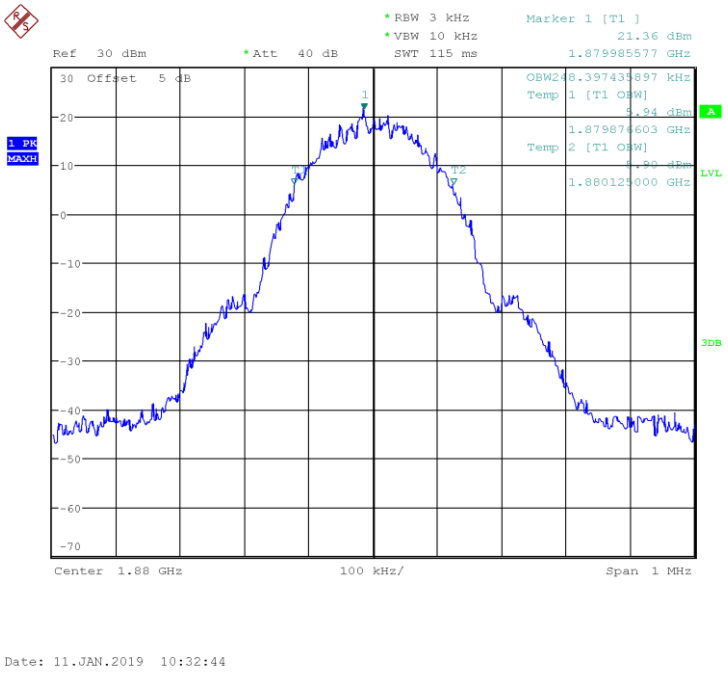

Fig.7 **Channel 661-Occupied Bandwidth (99%)**

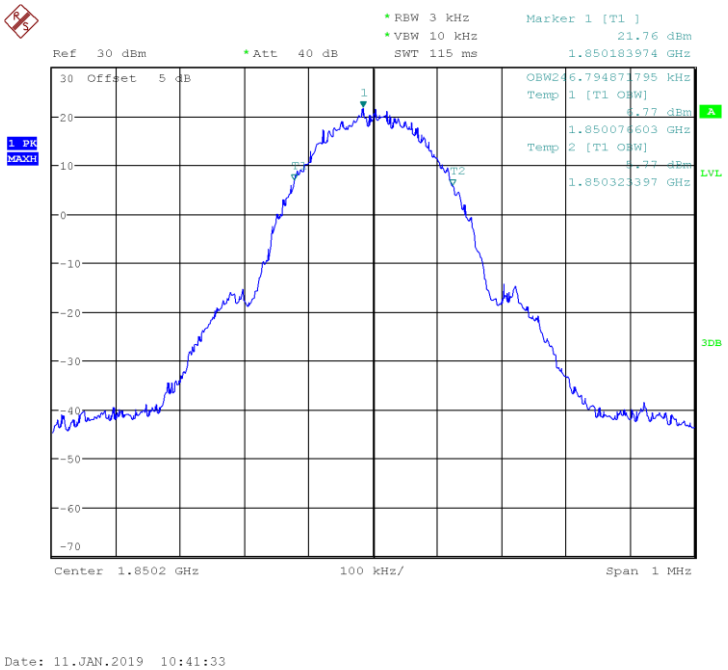

Fig.8 **Channel 512-Occupied Bandwidth (99%)**

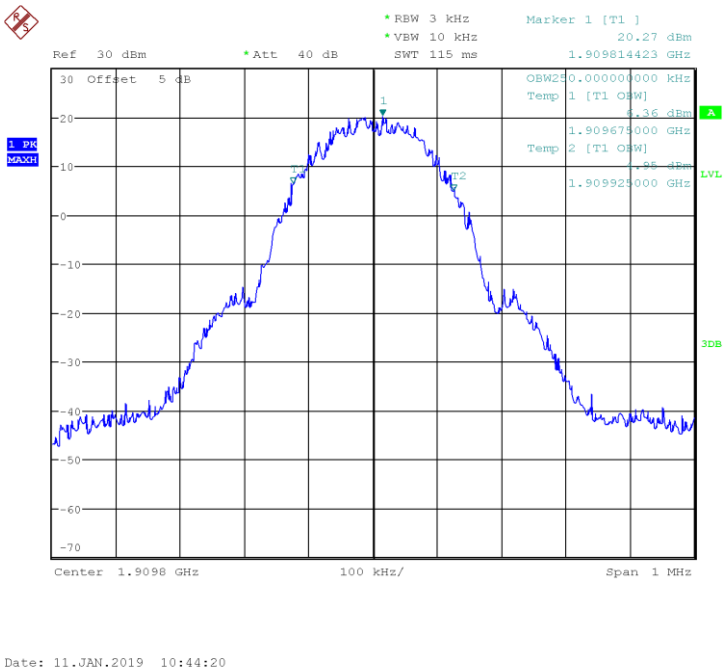

Fig.9 **Channel 810-Occupied Bandwidth (99%)**

EDGE 1900

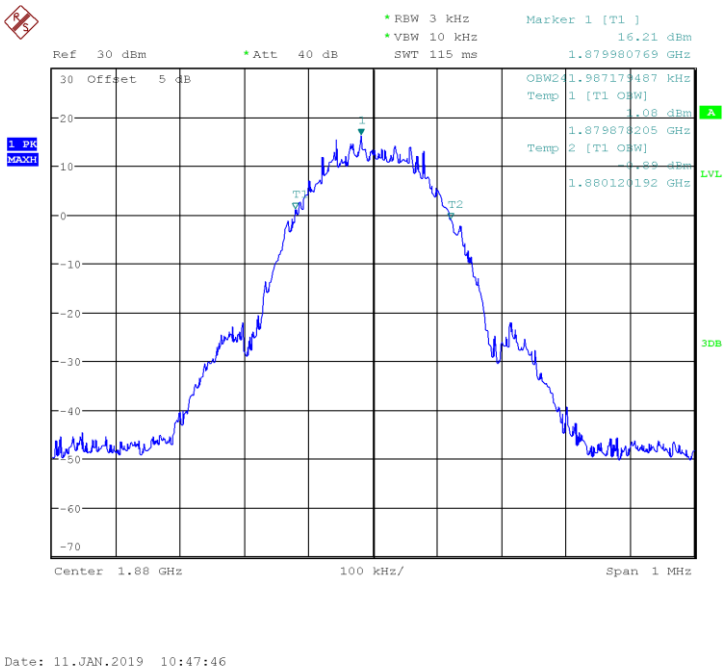

Fig.10 **Channel 661-Occupied Bandwidth (99%)**

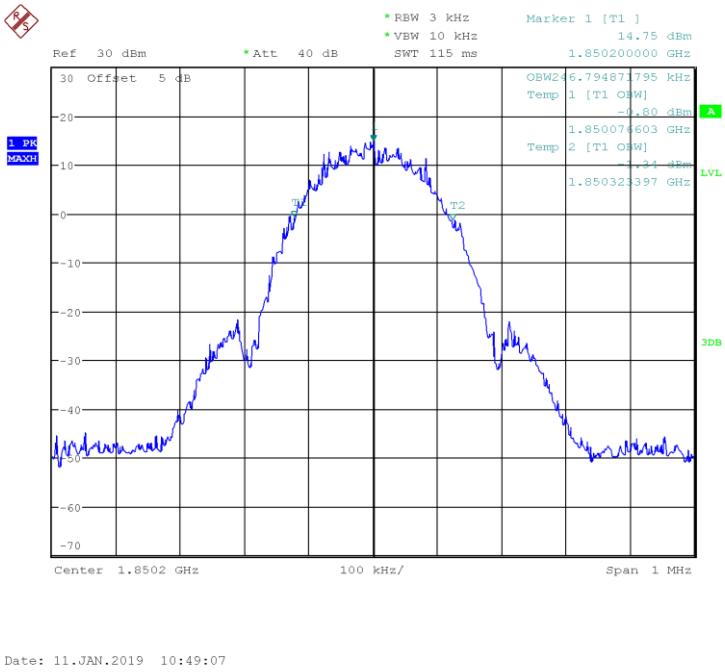

Fig.11 **Channel 512-Occupied Bandwidth (99%)**

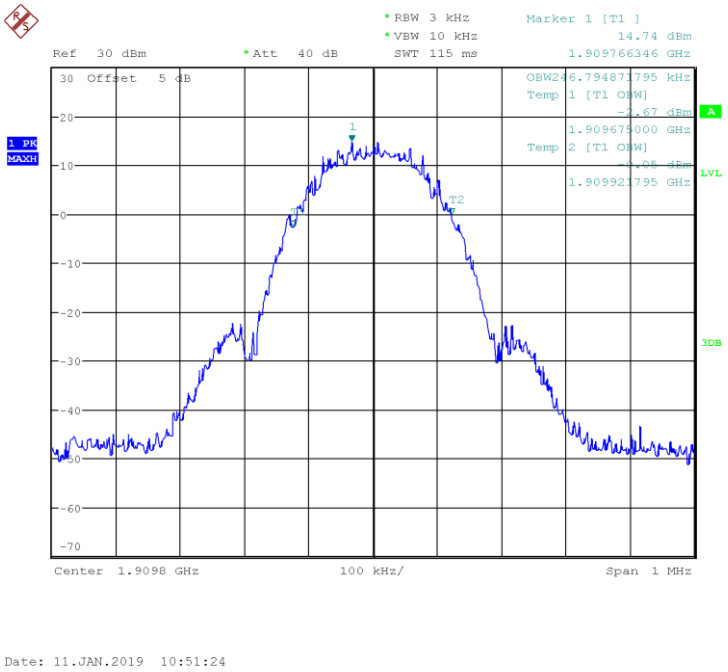

Fig.12 **Channel 810-Occupied Bandwidth (99%)**

WCDMA BAND II		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(MHz)
Mid 9400	1880	4.135
Low 9262	1852.4	4.119
High 9538	1907.6	4.135

Conclusion: PASS

WCDMA BAND II

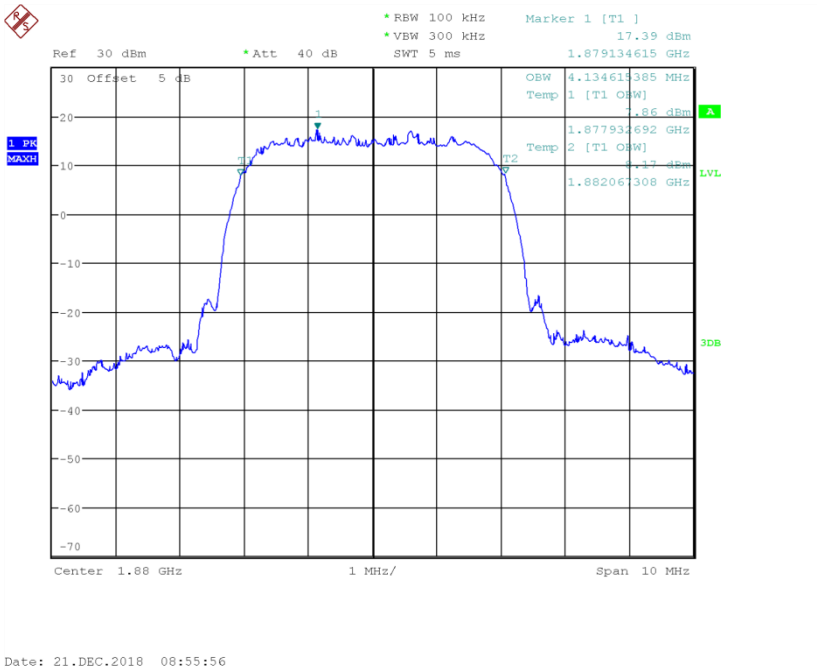

Fig.13 **Channel 9400-Occupied Bandwidth (99%)**

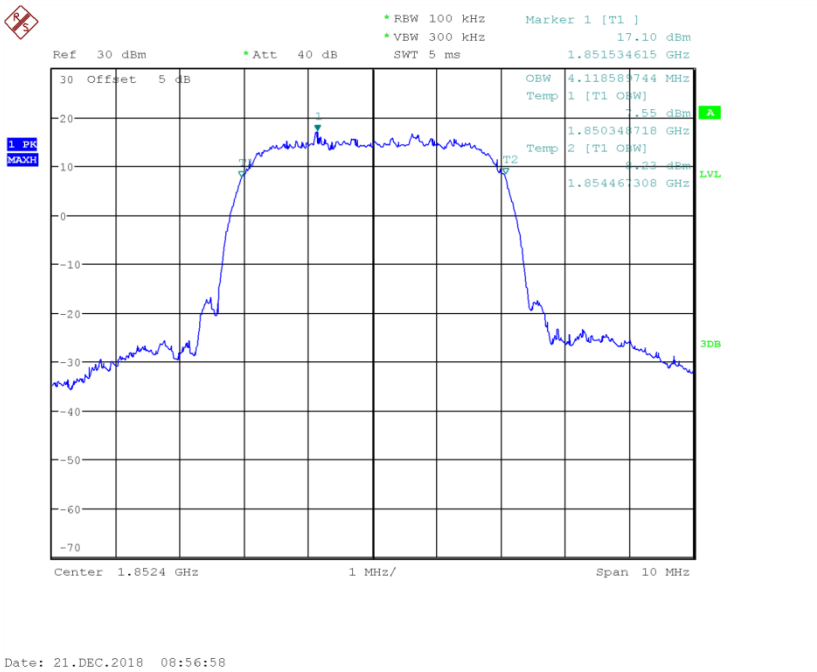

Fig.14 **Channel 9262-Occupied Bandwidth (99%)**

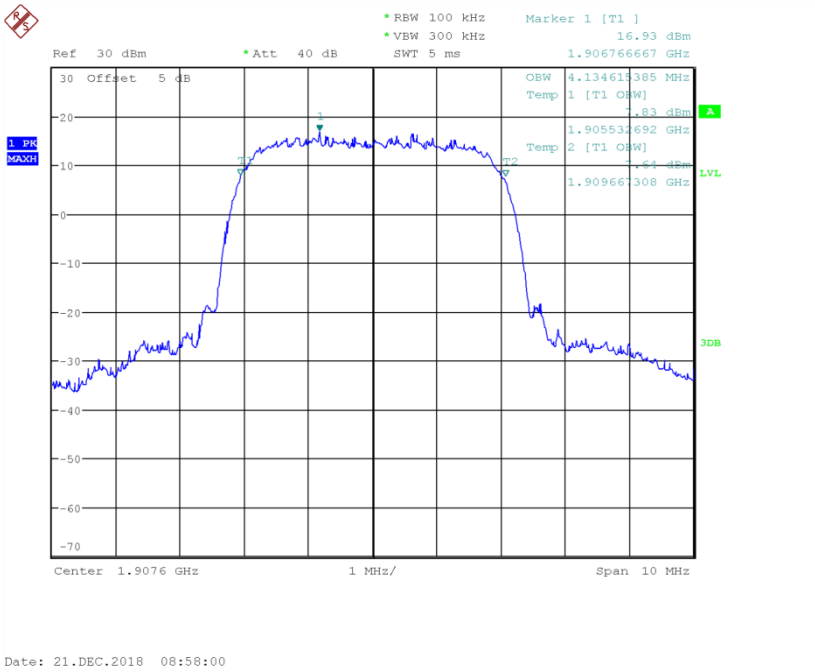

Fig.15 **Channel 9538-Occupied Bandwidth (99%)**

WCDMA BAND IV		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(MHz)
Mid 1413	1732.6	4.135
Low 1312	1712.4	4.119
High 1513	1752.6	4.135

Conclusion: PASS

WCDMA BAND IV

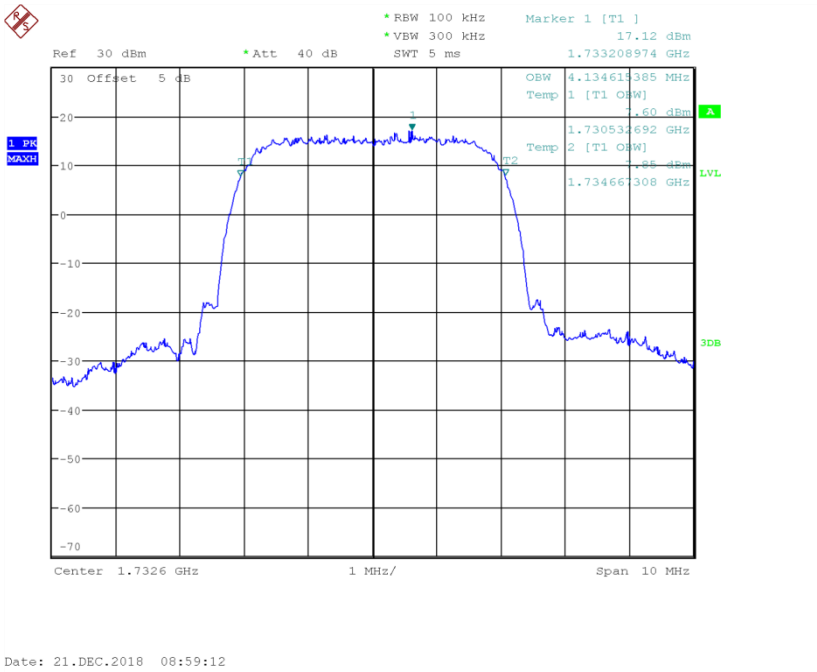

Fig.16 **Channel 1413-Occupied Bandwidth (99%)**

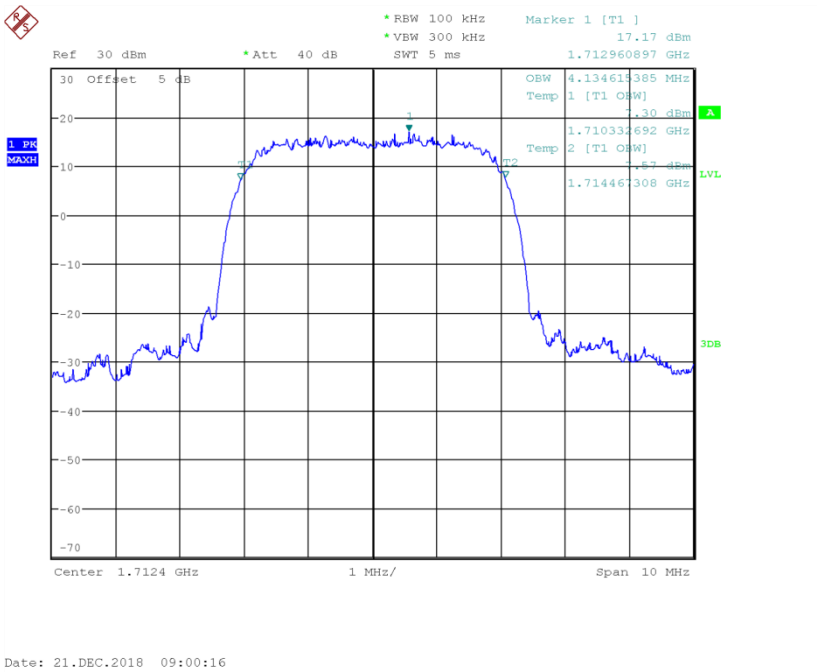

Fig.17 **Channel 1312-Occupied Bandwidth (99%)**

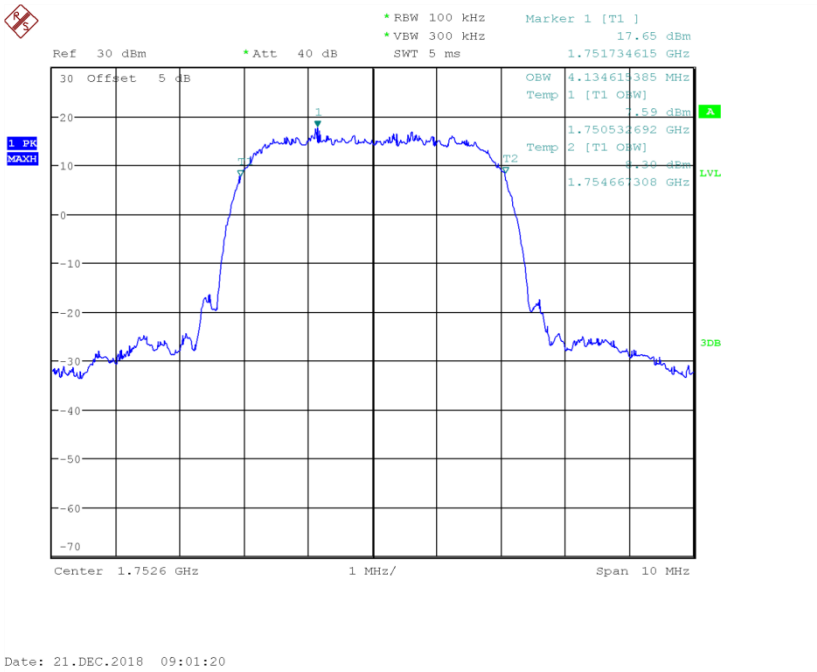

Fig.18 **Channel 1513-Occupied Bandwidth (99%)**

WCDMA BAND V		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(MHz)
Mid 4183	836.6	4.135
Low 4132	826.4	4.135
High 4233	846.6	4.119

Conclusion: PASS

WCDMA BAND V

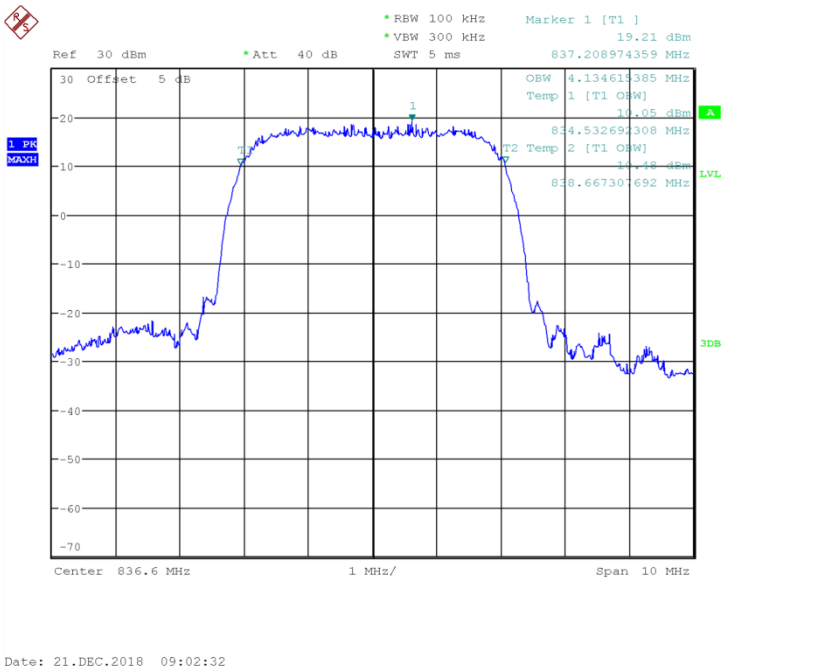

Fig.19 **Channel 4183-Occupied Bandwidth (99%)**

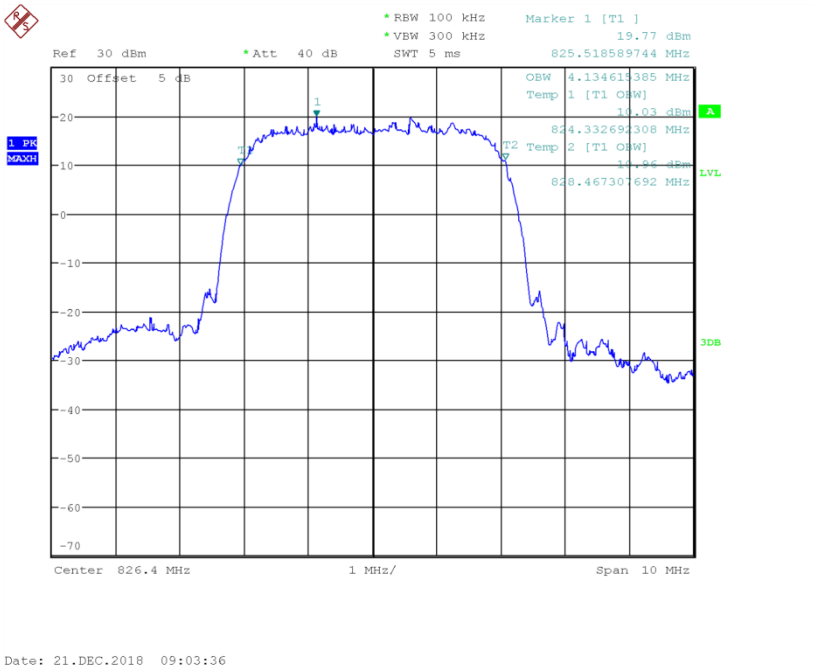

Fig.20 **Channel 4132-Occupied Bandwidth (99%)**

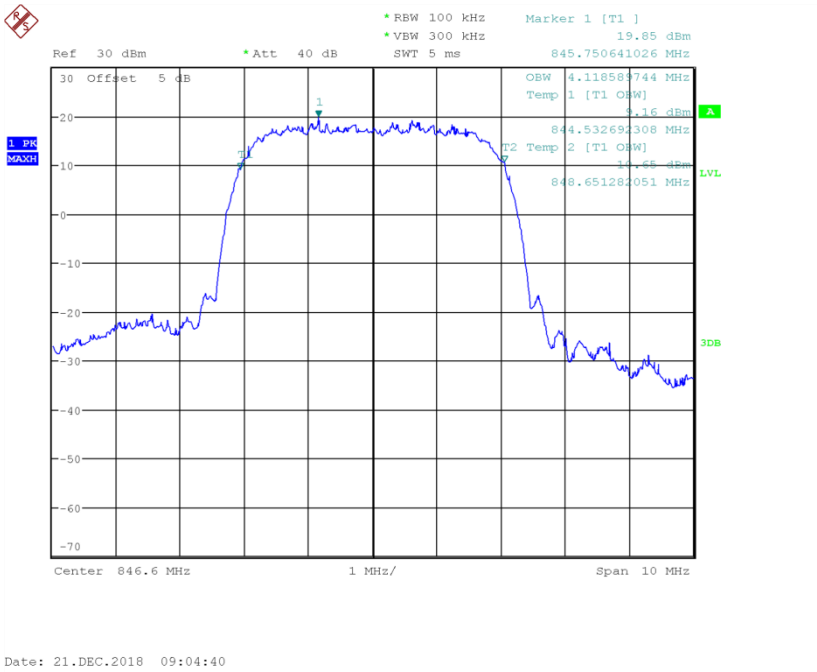

Fig.21 **Channel 4233-Occupied Bandwidth (99%)**

ANNEX A.4. -26dB Emission Bandwidth

Method of test please refer to KDB971168 D01 v03 clause 4.0.

A.4.1. -26dB Emission Bandwidth

Similar to conducted emissions; occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of GSM850, PCS1900, WCDMA BANDII and WCDMA BANDV.

A.4.2 Test Procedure:

1. The EUT output RF connector was connected with a short cable to the signal analyzer.
2. RBW was set to about 1% of emission BW, VBW >= 3 times RBW,.
3. 26dB bandwidth were measured, the occupied bandwidth is delta frequency between the two points where the display line intersects the signal trace.

A.4.3 Measurement methods:

For GSM: signal analyzer setting as: RBW=3KHz;VBW=10KHz;Span=1MHz.

For WCDMA: signal analyzer setting as: RBW=50KHz;VBW=200KHz;Span=10MHz.

A.4.4 Test results:

GPRS 850		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(kHz)
Mid 189	836.4	314.103
Low 128	824.2	299.679
High 251	848.8	318.91
EDGE 850		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(kHz)
Mid 189	836.4	304.487
Low 128	824.2	307.692
High 251	848.8	304.487

Conclusion: PASS

GPRS 850

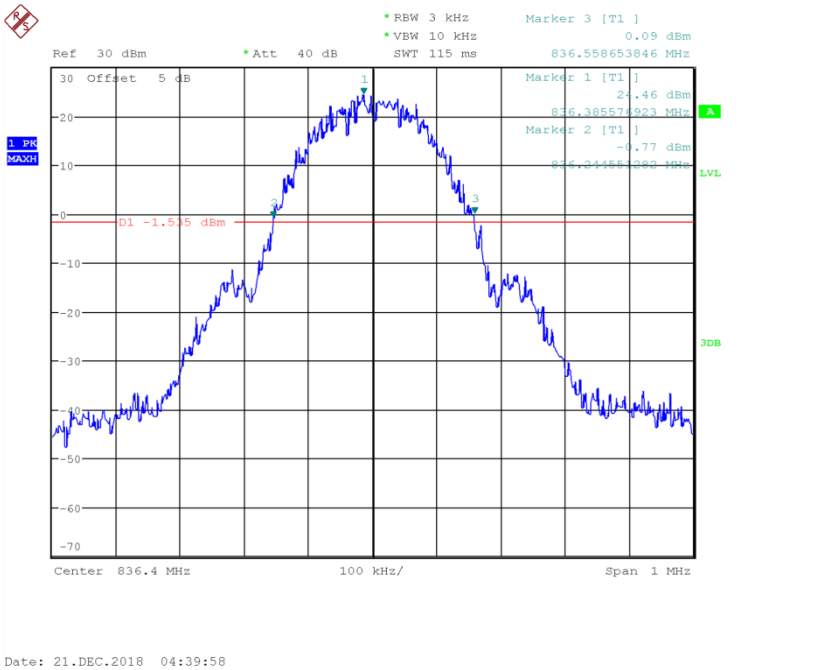

Fig.22 **Channel 189- Emission Bandwidth (-26dBc BW)**

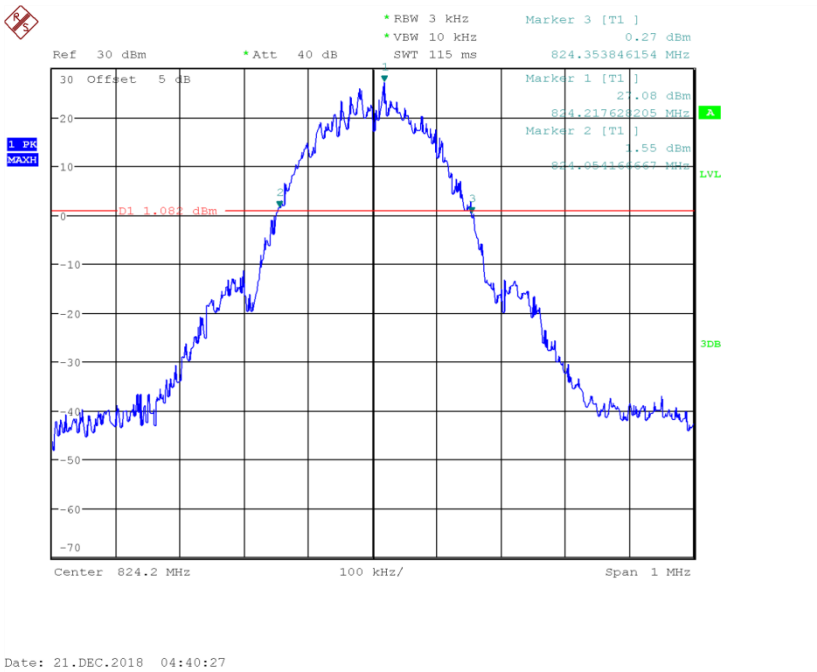

Fig.23 **Channel 128- Emission Bandwidth (-26dBc BW)**

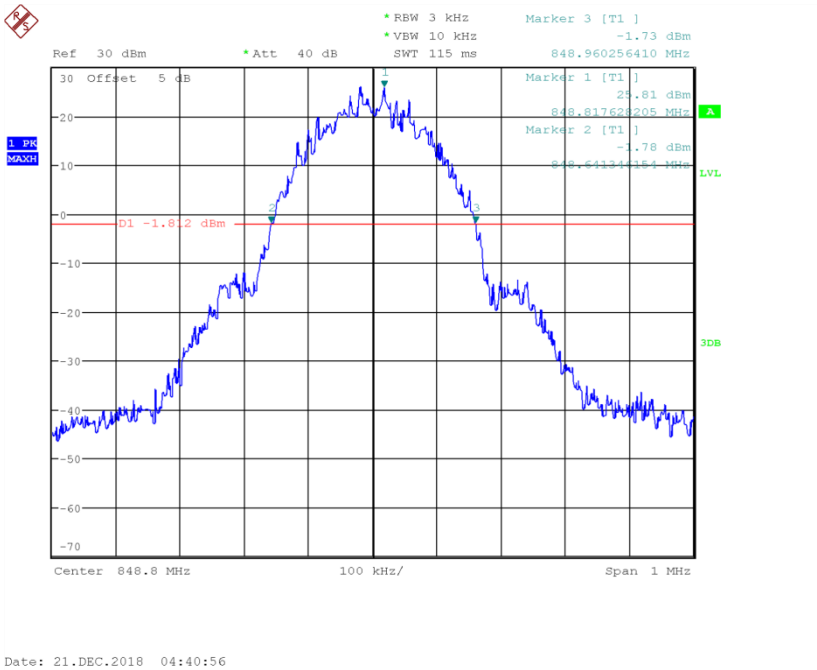

Fig.24 **Channel 251- Emission Bandwidth (-26dBc BW)**

EDGE 850

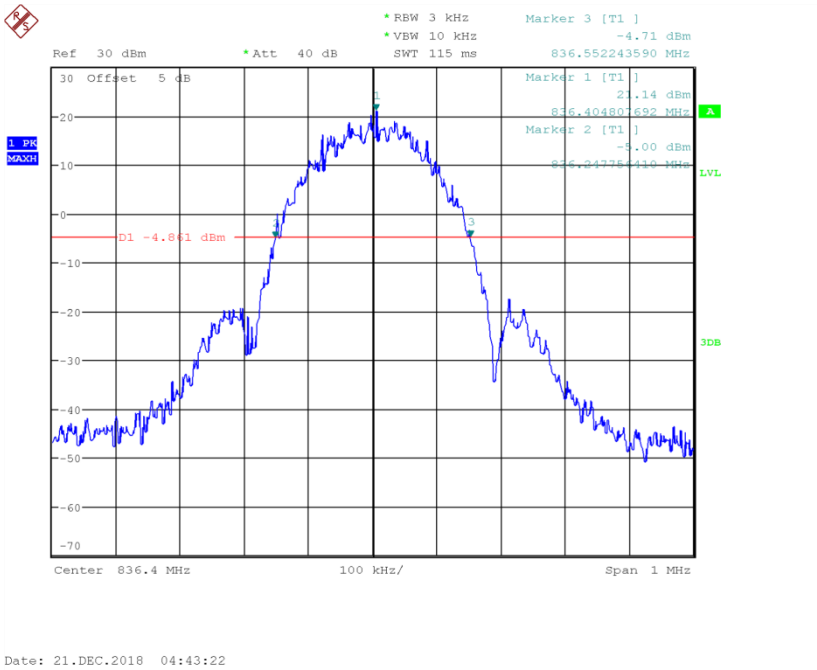

Fig.25 **Channel 189- Emission Bandwidth (-26dBc BW)**

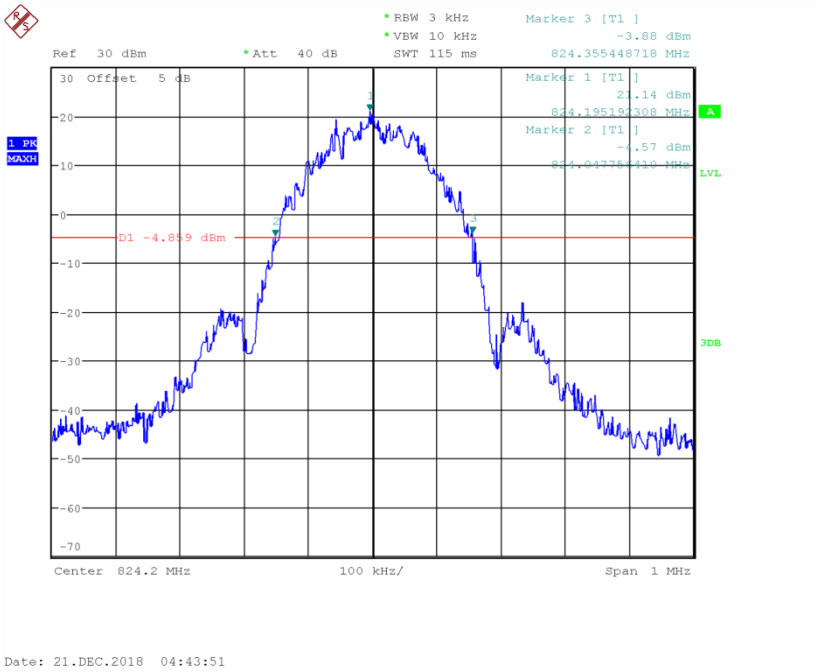

Fig.26 **Channel 128- Emission Bandwidth (-26dBc BW)**

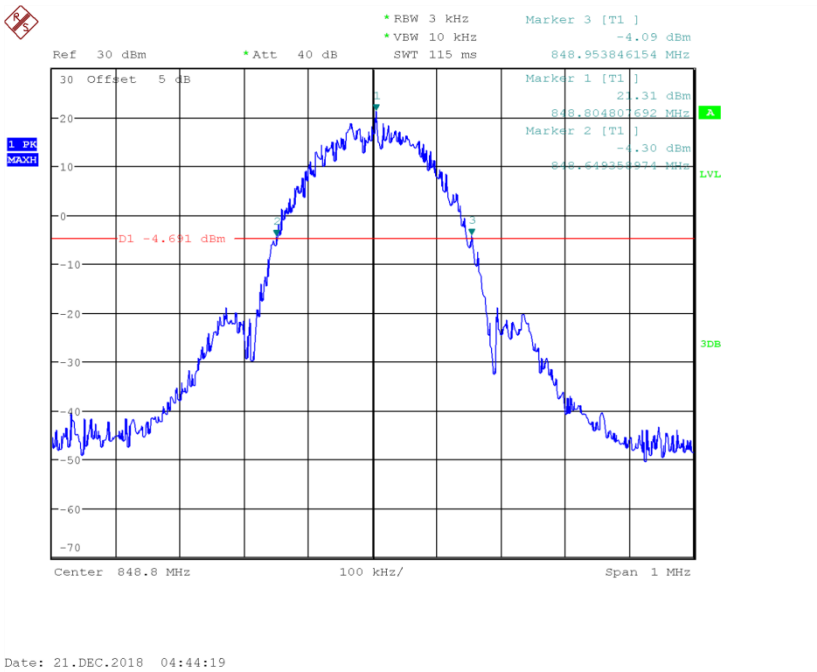

Fig.27 **Channel 251- Emission Bandwidth (-26dBc BW)**

GPRS1900		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(kHz)
Mid 661	1880	315.705
Low 512	1850.2	320.513
High 810	1909.8	317.308

EDGE1900		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(kHz)
Mid 661	1880	314.103
Low 512	1850.2	306.09
High 810	1909.8	291.667

Conclusion: PASS

GPRS 1900

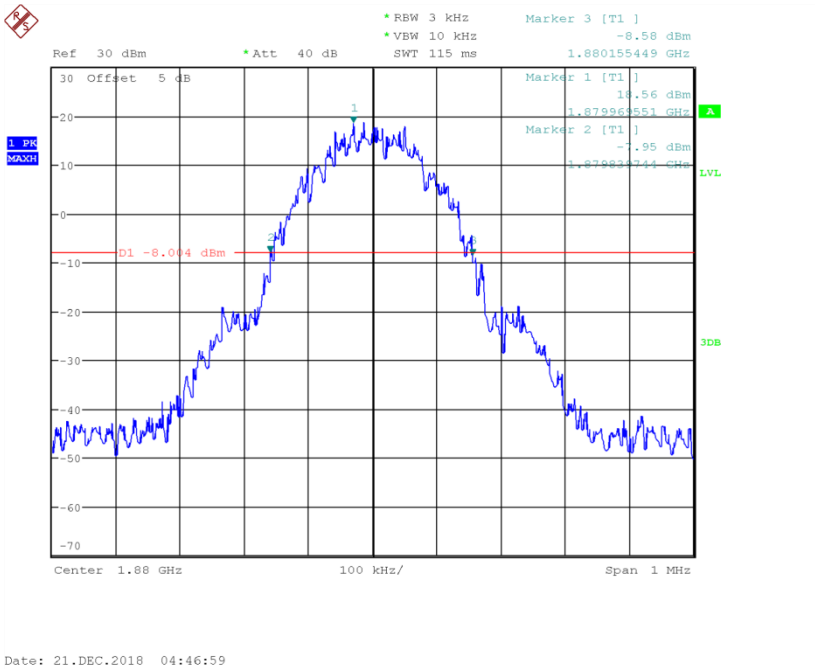

Fig.28 **Channel 661- Emission Bandwidth (-26dBc BW)**

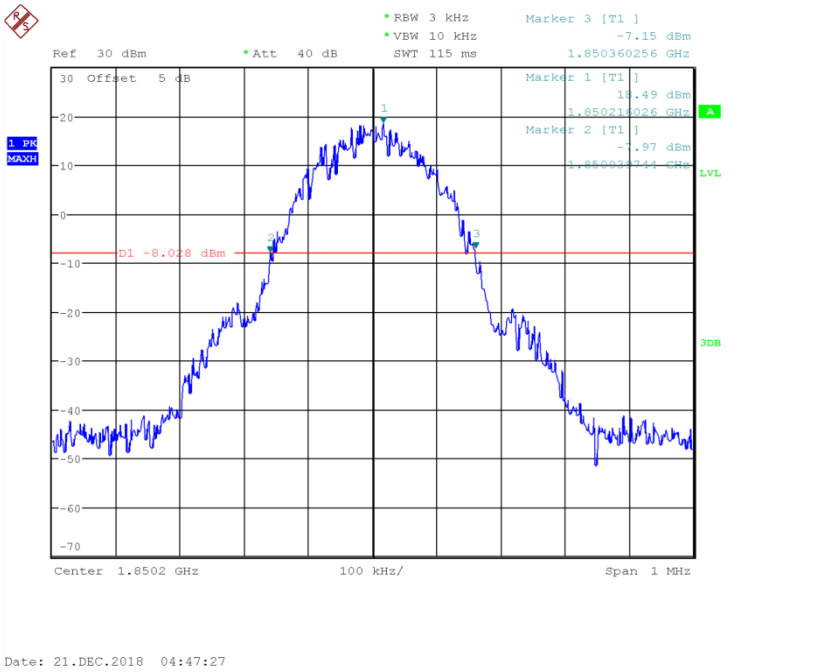

Fig.29 **Channel 512- Emission Bandwidth (-26dBc BW)**

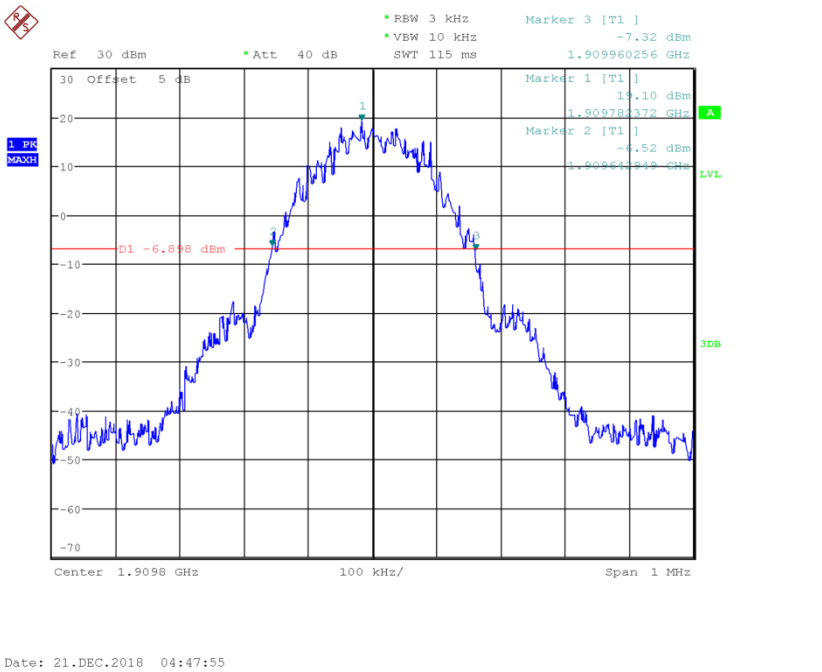

Fig.30 **Channel 810- Emission Bandwidth (-26dBc BW)**

EDGE 1900

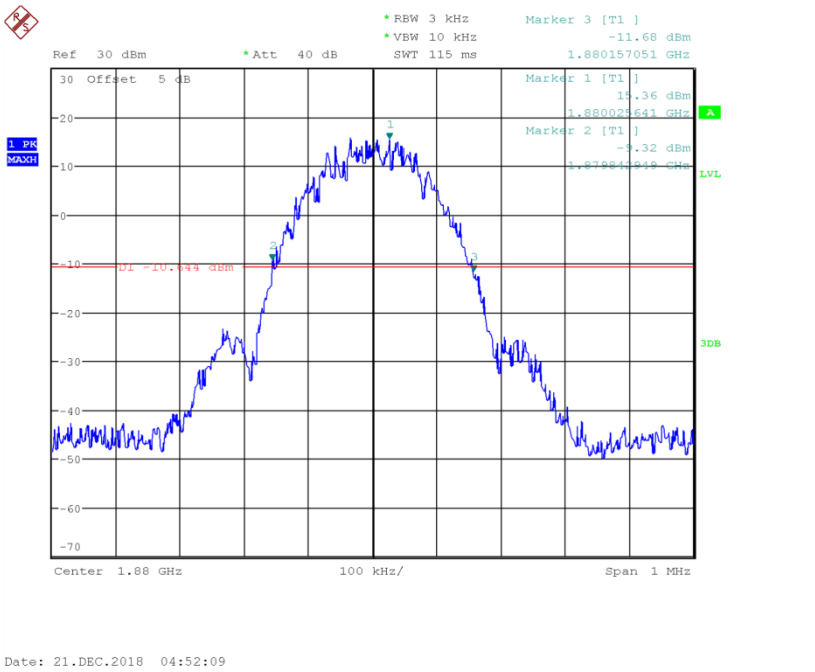

Fig.31 **Channel 661- Emission Bandwidth (-26dBc BW)**

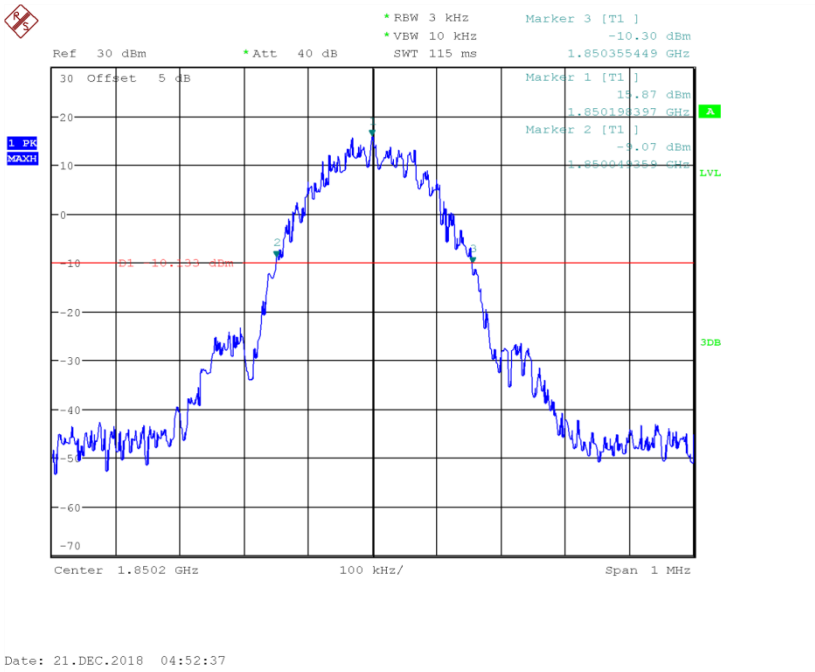

Fig.32 **Channel 512- Emission Bandwidth (-26dBc BW)**

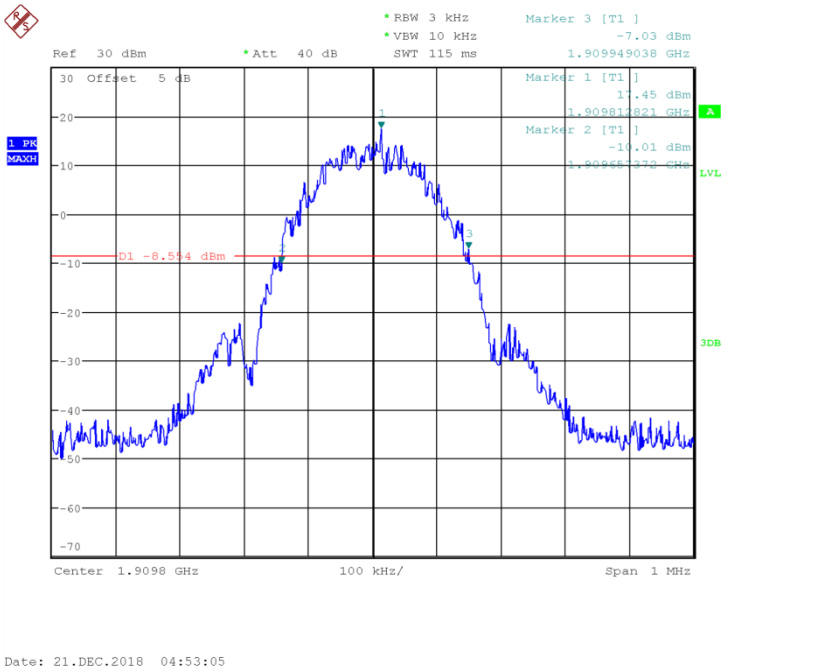

Fig.33 **Channel 810- Emission Bandwidth (-26dBc BW)**

WCDMA BAND II		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(MHz)
Mid 9400	1880	4.712
Low 9262	1852.4	4.696
High 9538	1907.6	4.712

Conclusion: PASS

WCDMA BAND II

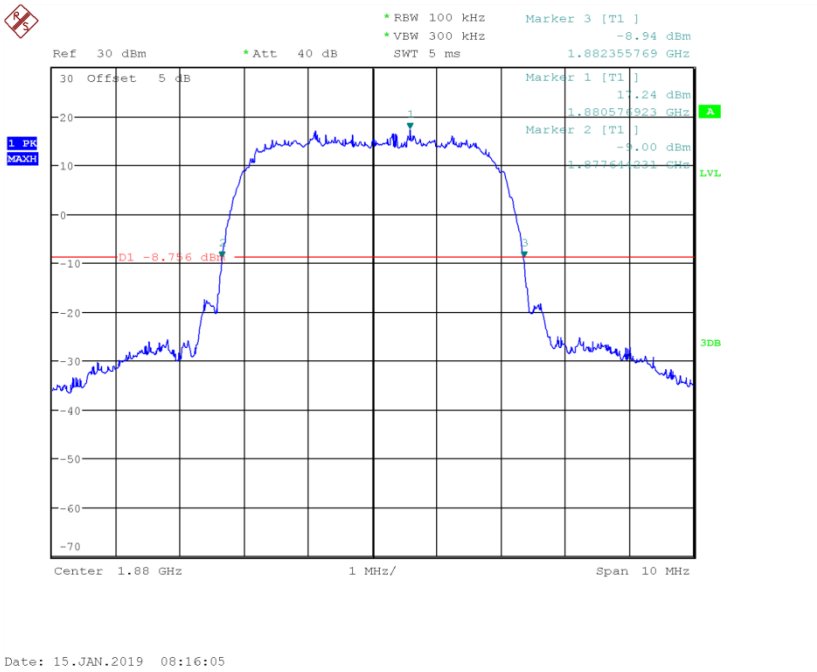

Fig.34 **Channel 9400- Emission Bandwidth (-26dBc BW)**

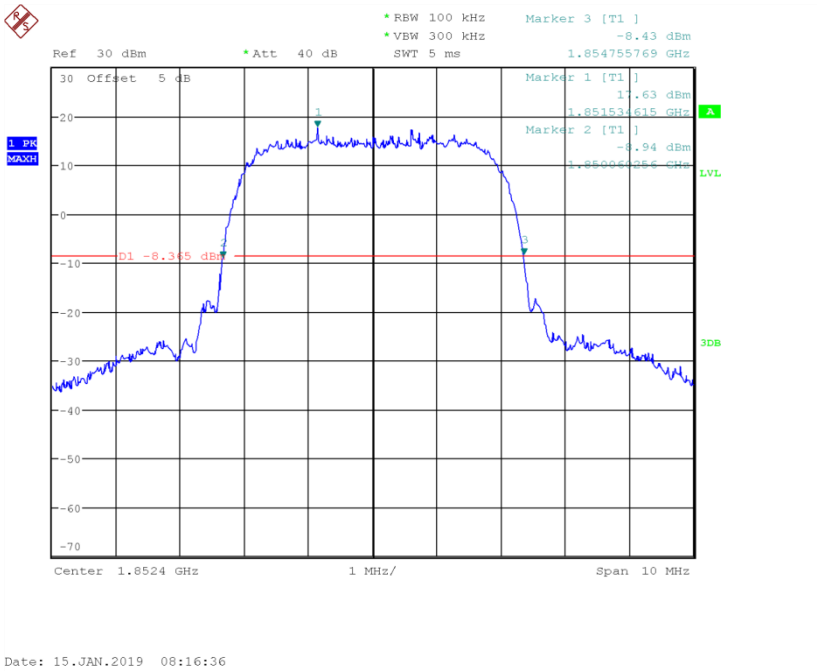

Fig.35 **Channel 9262- Emission Bandwidth (-26dBc BW)**

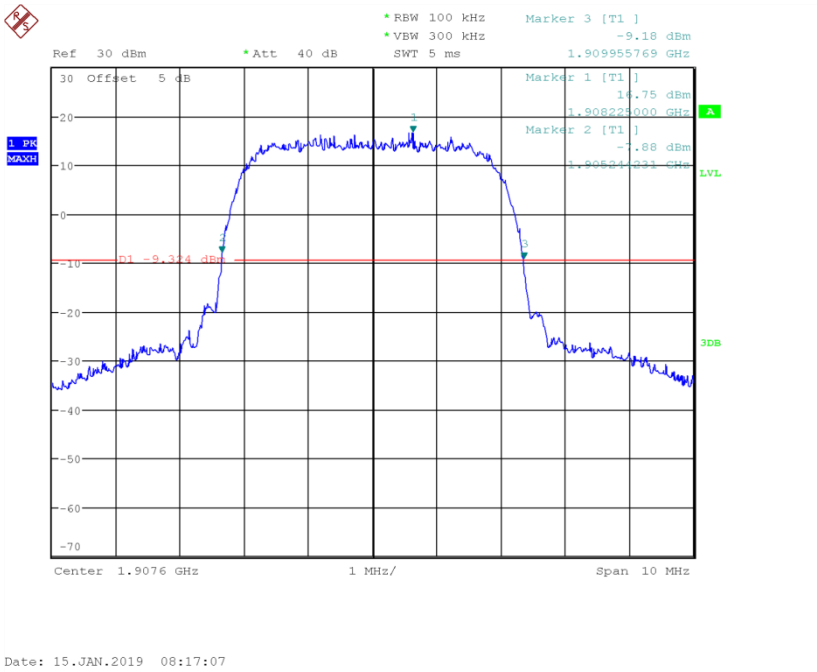

Fig.36 **Channel 9538- Emission Bandwidth (-26dBc BW)**

WCDMA BAND IV		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(MHz)
Mid 1413	1732.6	4.728
Low 1312	1712.4	4.712
High 1513	1752.6	4.712

Conclusion: PASS

WCDMA BAND IV

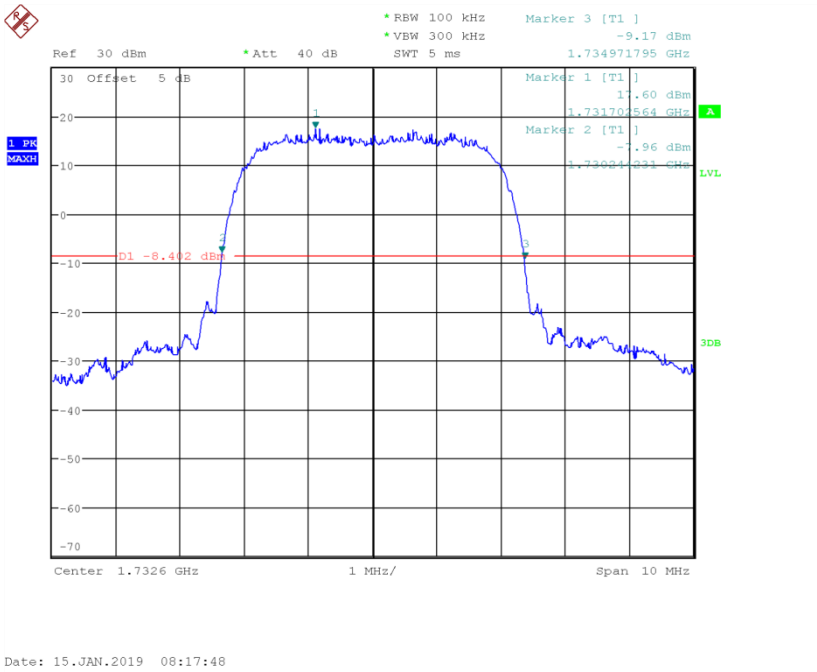

Fig.37 **Channel 1413- Emission Bandwidth (-26dBc BW)**

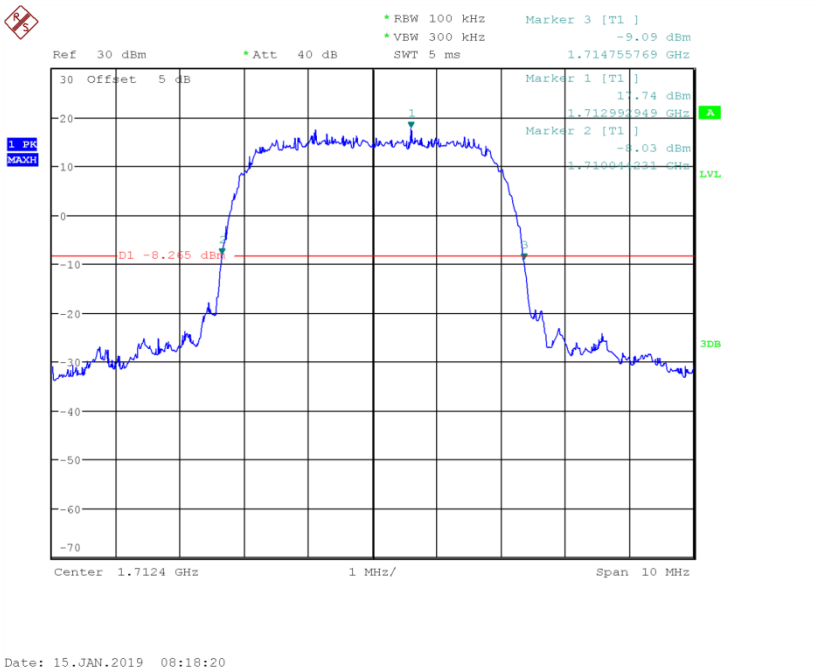

Fig.38 **Channel 1312- Emission Bandwidth (-26dBc BW)**

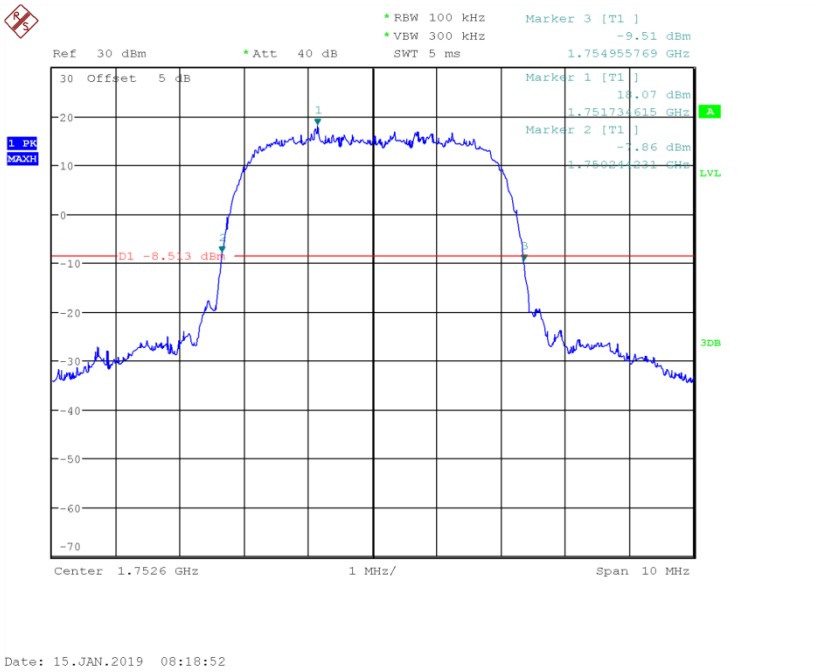

Fig.39 **Channel 1513- Emission Bandwidth (-26dBc BW)**

WCDMA BAND V		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(MHz)
Mid 4183	836.6	4.712
Low 4132	826.4	4.712
High 4233	846.6	4.712

Conclusion: PASS

WCDMA BAND V

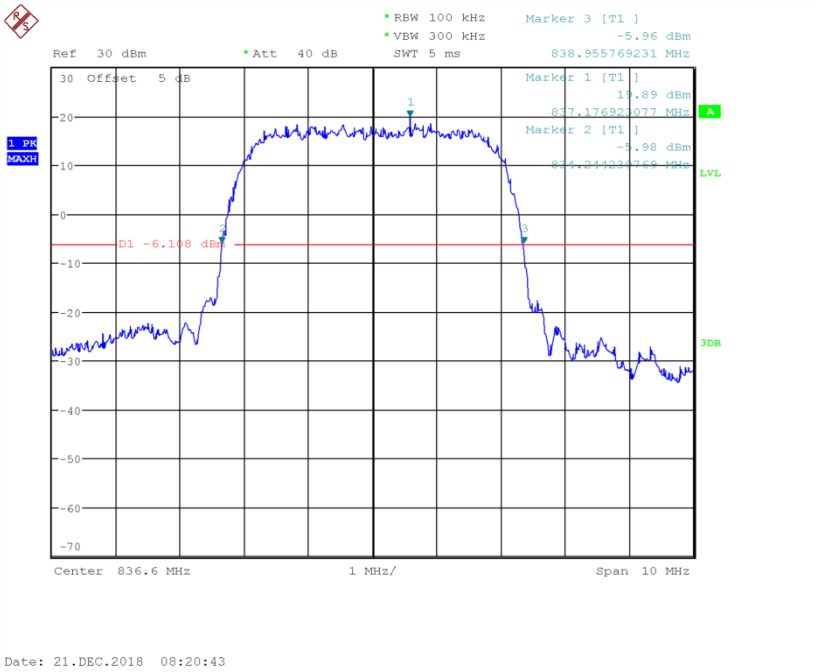

Fig.40 **Channel 4183- Emission Bandwidth (-26dBc BW)**

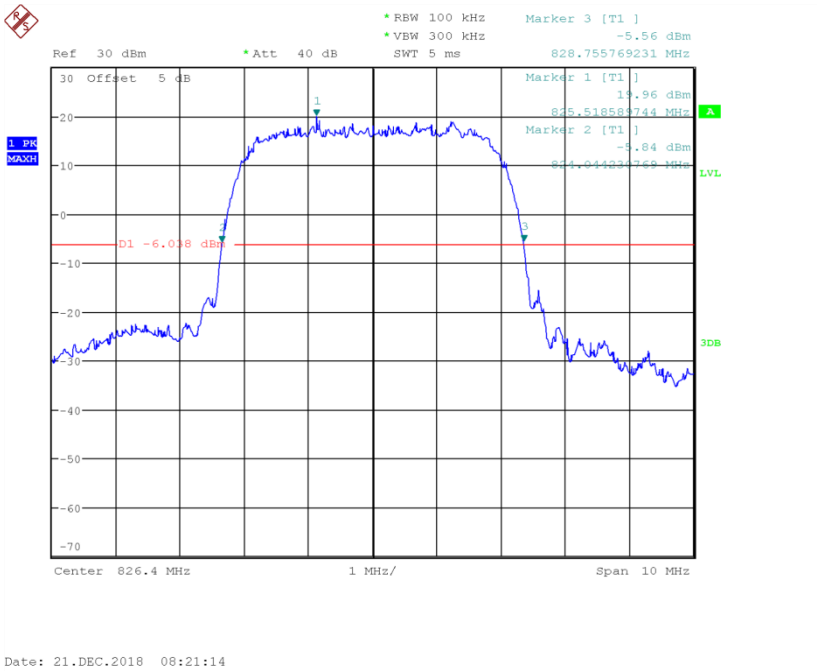

Fig.41 **Channel 4132- Emission Bandwidth (-26dBc BW)**

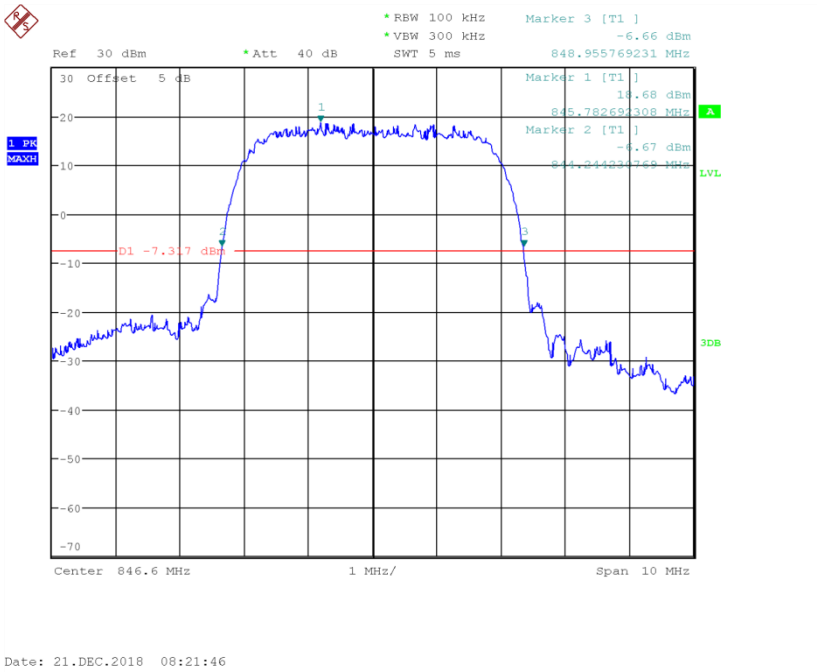

Fig.42 **Channel 4233- Emission Bandwidth (-26dBc BW)**

ANNEX A.5. Band Edge at antenna terminals

Method of test measurements please refer to KDB971168 D01 v03 clause 6

A.5.1 Limit:

The magnitude of each spurious and harmonic emission that can be detected when the equipment is operated under the conditions specification in the instruction manual and/or alignment procedure, shall not be less than 43+10log (Mean power in watts) dBc below the mean power output outside a license's frequency block(-13dBm).

A.5.2 Test procedure:

1. The RF output of the transceiver was connected to a signal analyzer through appropriate attenuation.
2. In the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.
3. The RF fundamental frequency should be excluded against the limit line in the operating frequency band
4. The limit line is derived from 43+10log(P) Db below the transmitter power P(Watts)
   =P(W)-[43+10log(P)](Db)
   =[30+10log(P)](dBm)-[43+10log(P)](Db)
   =-13dBm

A.5.3 Test Result:

GPRS 850

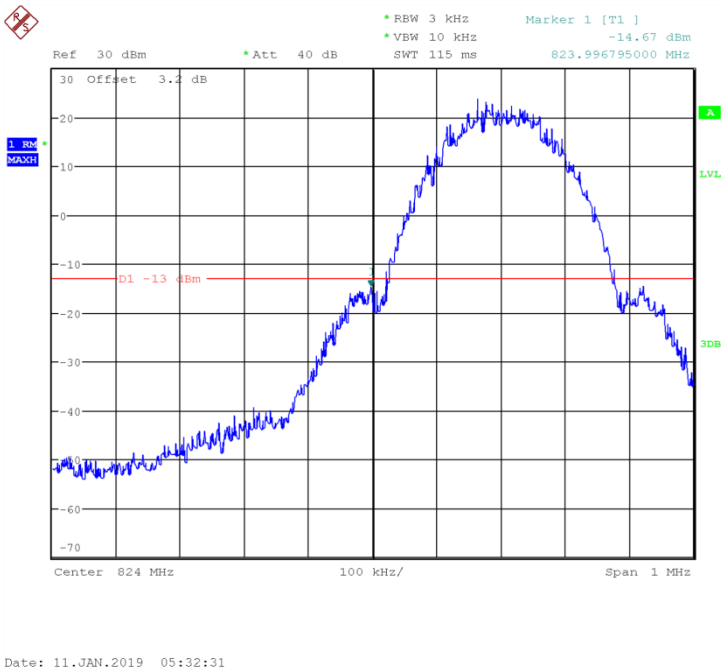

Fig.43 **Channel 128- LOW BAND EDGE BLOCK**

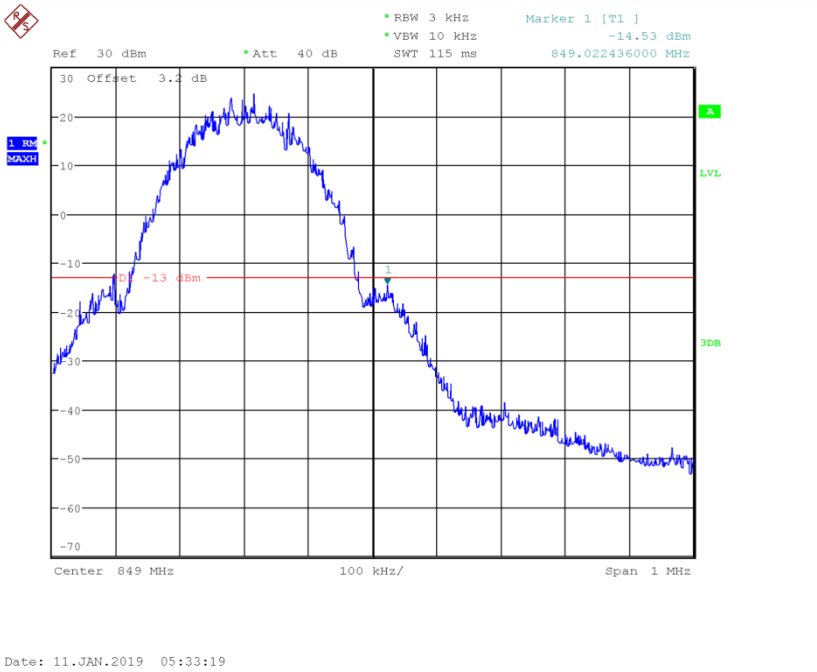

Fig.44 **Channel 251- LOW BAND EDGE BLOCK**

EDGE 850

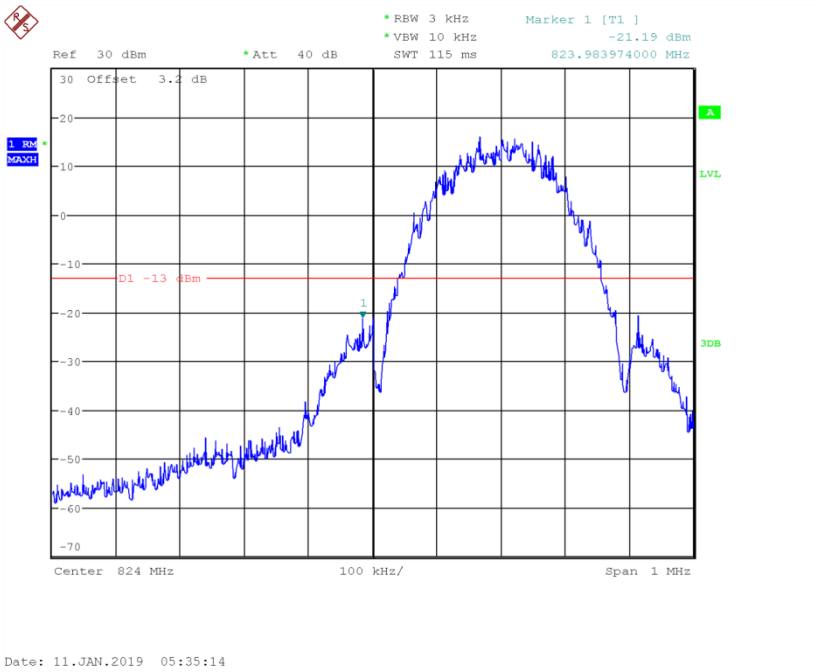

Fig.45 **Channel 128- LOW BAND EDGE BLOCK**

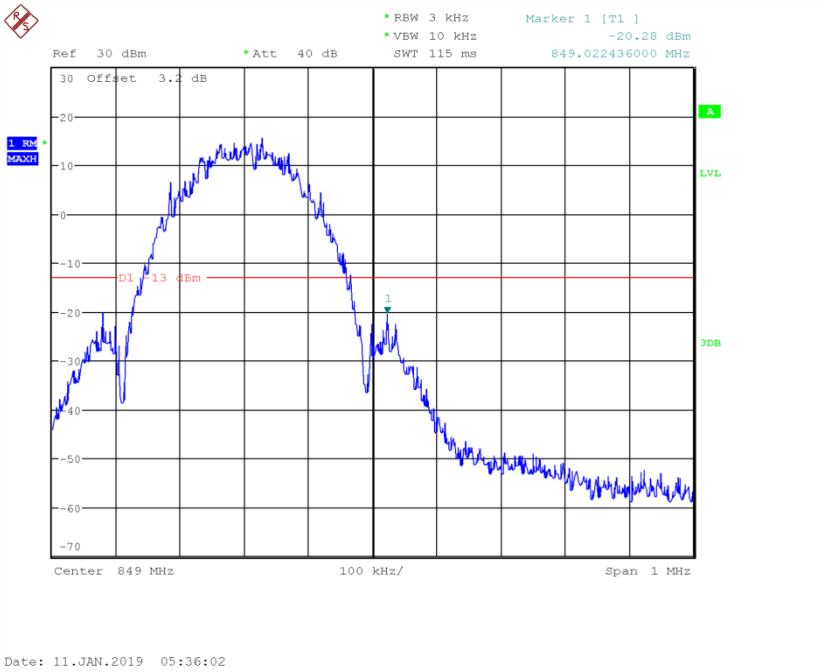

Fig.46 **Channel 251- LOW BAND EDGE BLOCK**

GPRS 1900

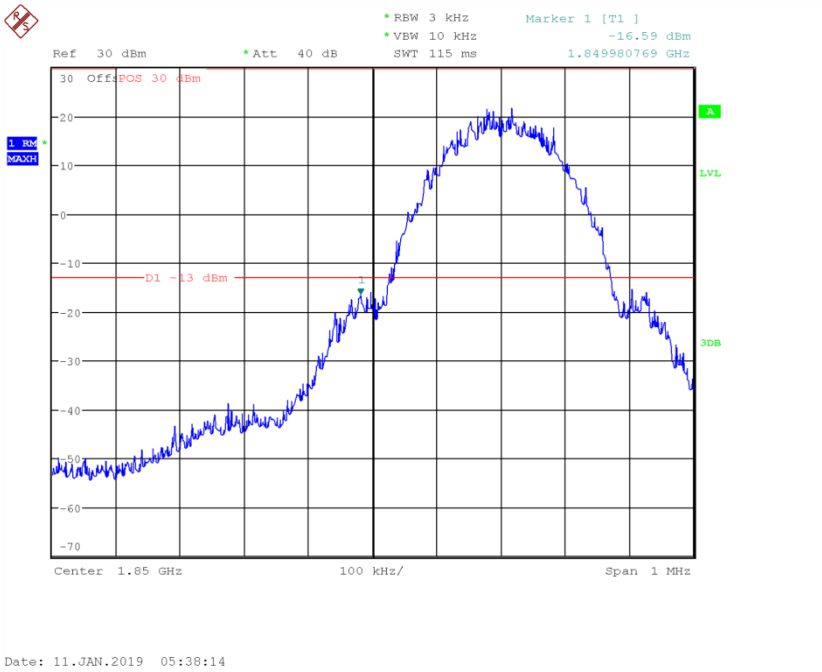

Fig.47 **Channel 512- LOW BAND EDGE BLOCK**

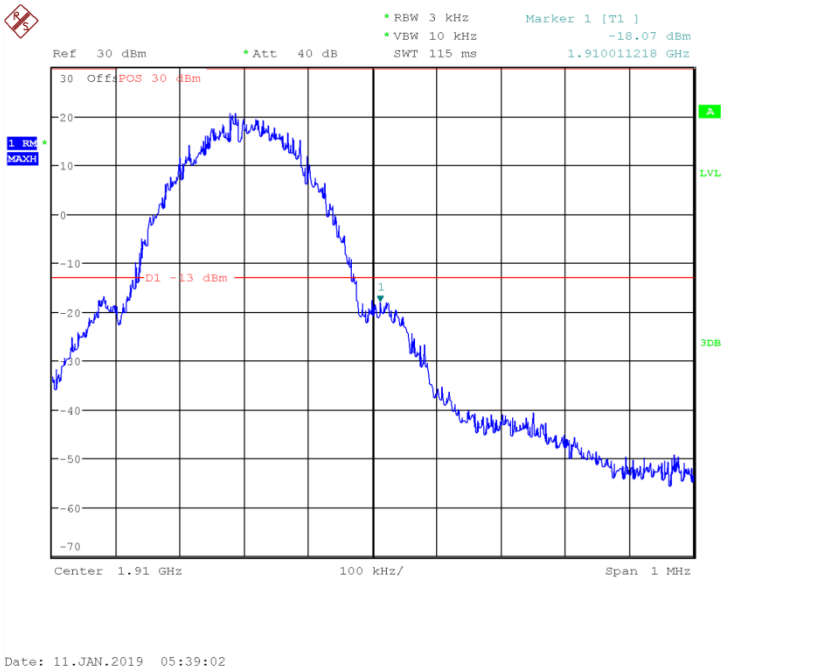

Fig.48 **Channel 810- LOW BAND EDGE BLOCK**

EDGE 1900

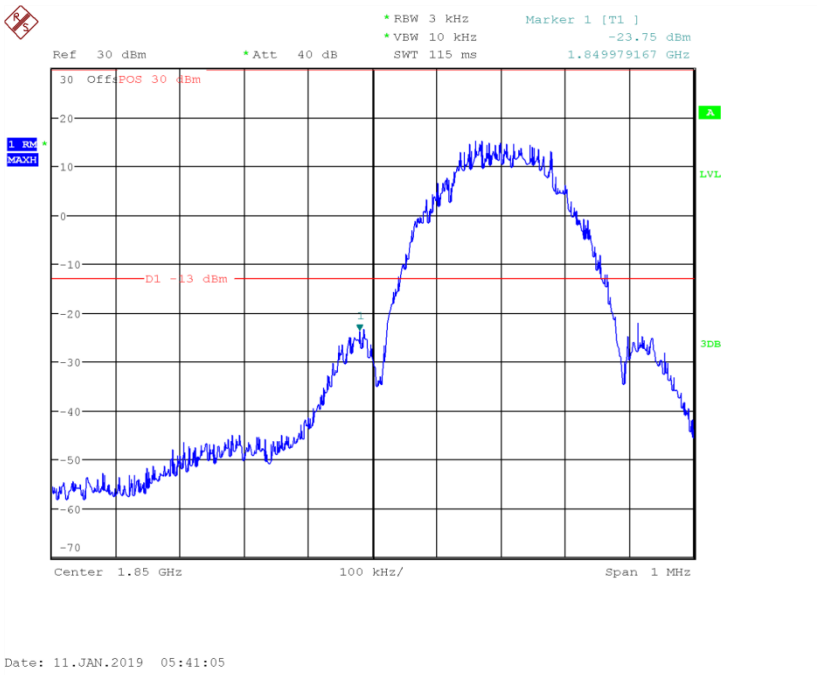

Fig.49 **Channel 512- LOW BAND EDGE BLOCK**

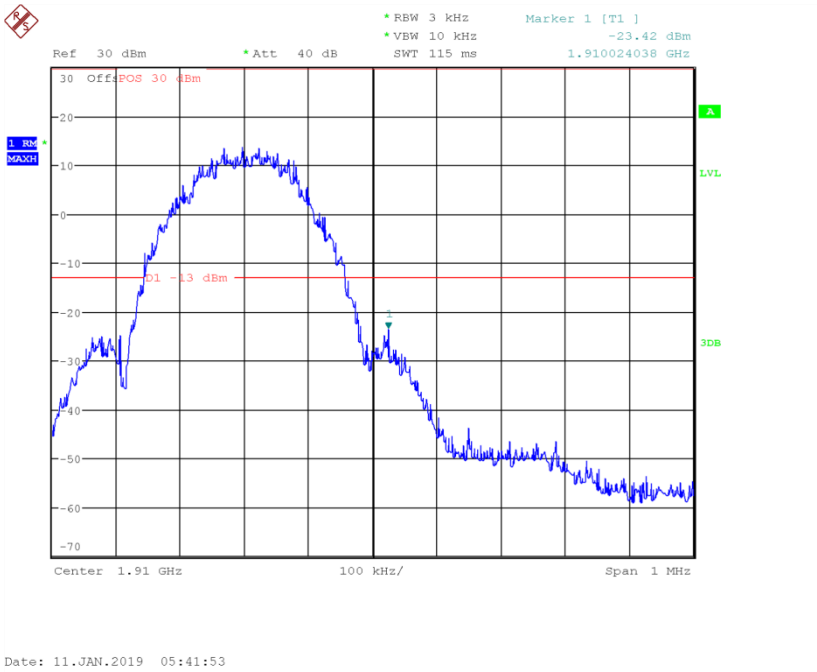

Fig.50 **Channel 810- LOW BAND EDGE BLOCK**

WCDMA BAND II

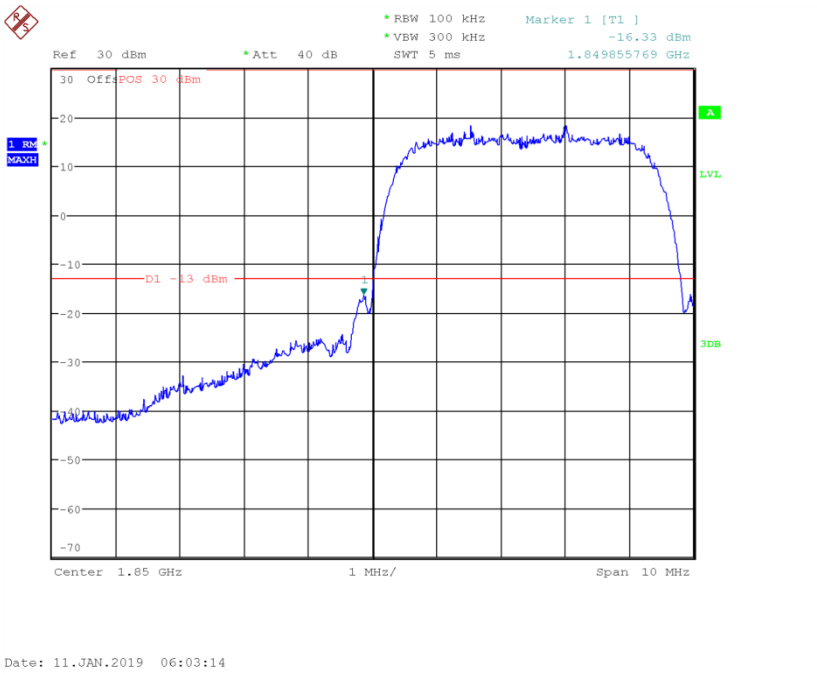

Fig.51 **Channel 9262- LOW BAND EDGE BLOCK**

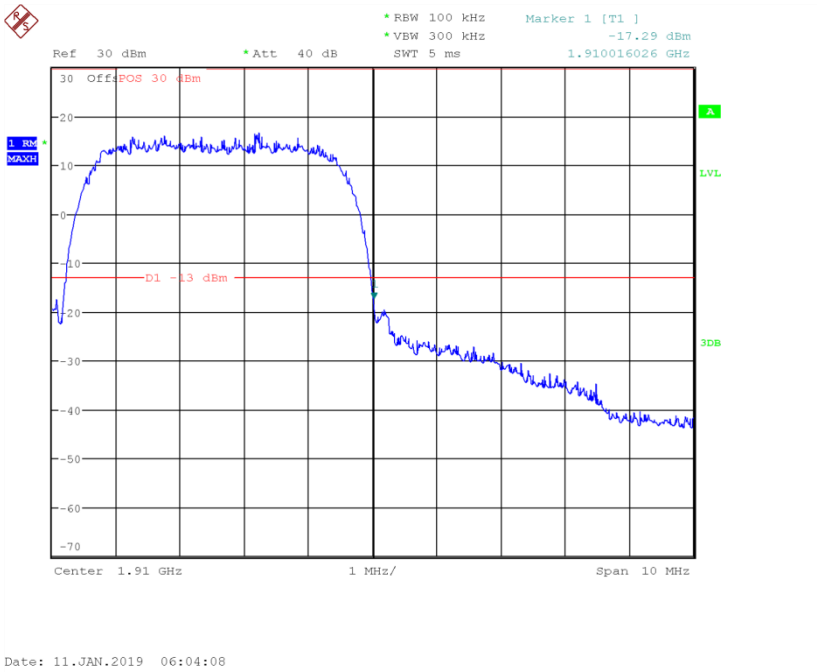

Fig.52 **Channel 9538- LOW BAND EDGE BLOCK**

Conclusion: PASS

WCDMA BAND IV

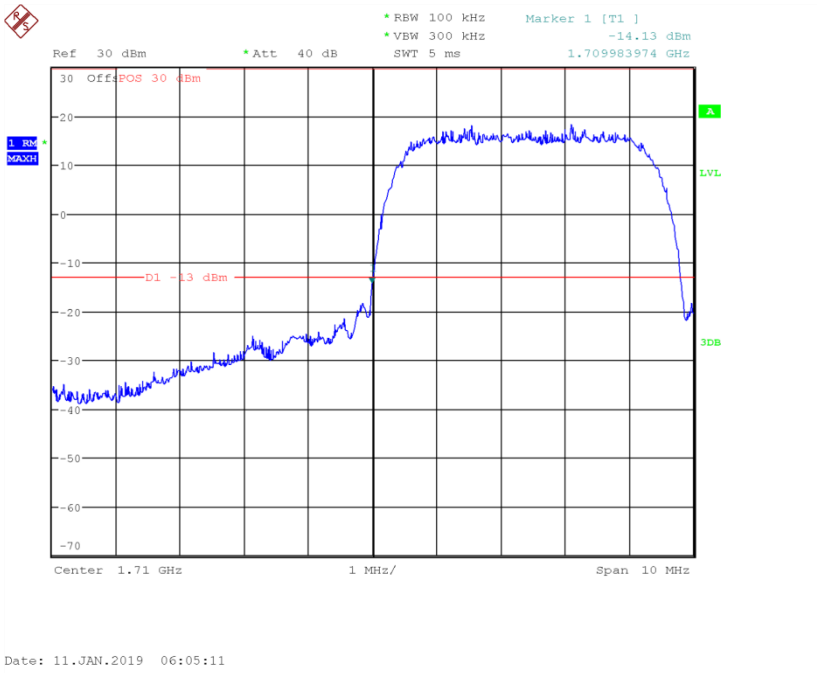

Fig.53 **Channel 1312- LOW BAND EDGE BLOCK**

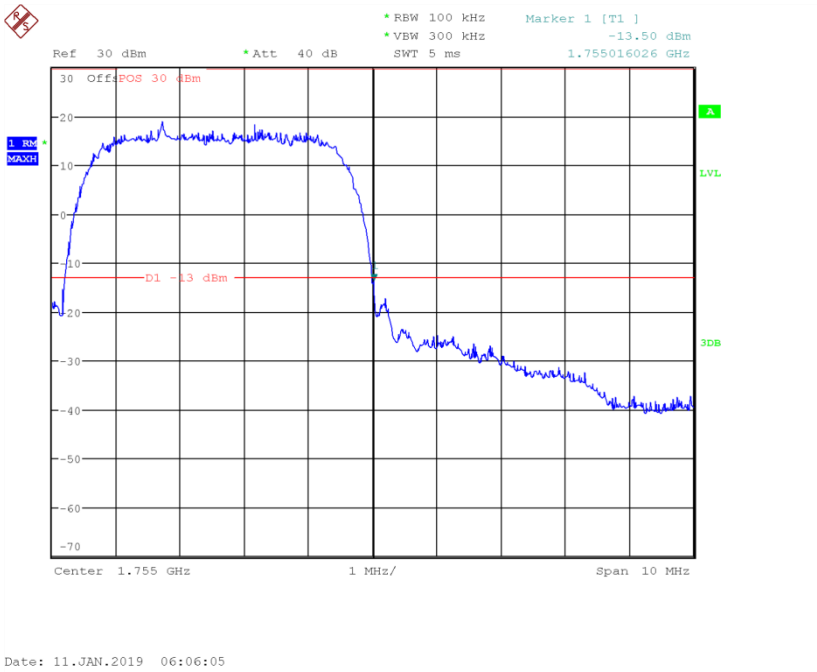

Fig.54 **Channel 1513- LOW BAND EDGE BLOCK**

Conclusion: PASS

WCDMA BAND V

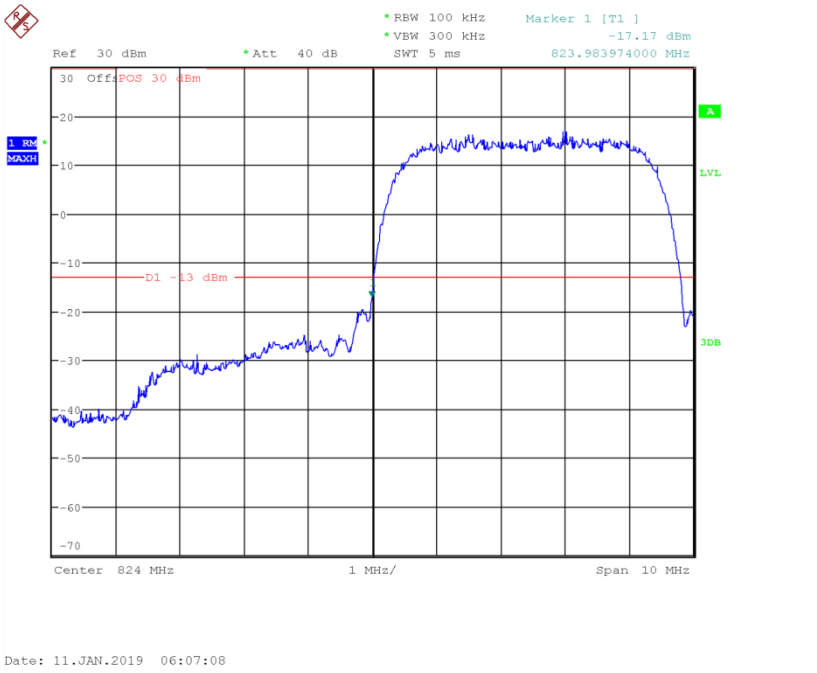

Fig.55 **Channel 4132- LOW BAND EDGE BLOCK**

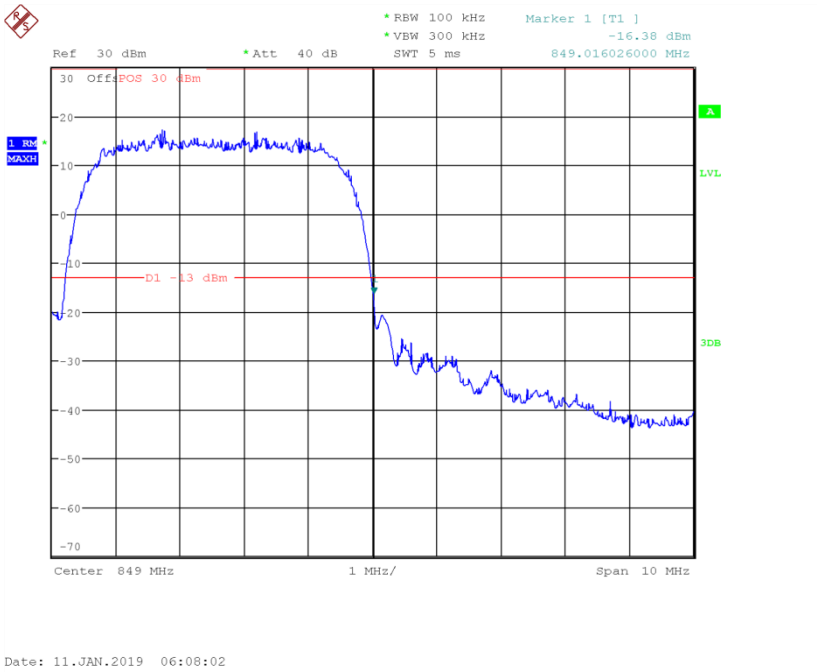

Fig.56 **Channel 4233- LOW BAND EDGE BLOCK**

Conclusion: PASS

ANNEX A.6. FREQUENCY STABILITY

Method of test measurements please refer to KDB971168 D01 v03 clause 9

A.6.1.Method of Measurement and test procedures

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a “call mode”. This is accomplished with the use of R&S CMU200 DIGITAL RADIO COMMUNICATION TESTER.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30℃.
3. With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on mid channel of GSM850, PCS1900, WCDMA BANDII and WCDMA BANDV, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10℃ increments from -30℃ to +50℃. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1 1/2 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50℃.
7. With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 C increments from +50℃ to -30℃. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.

A.6.2. Measurement Limit

A.6.2.1. For Hand carried battery powered equipment

According to the JTC standard the GSM frequency stability of the carrier shall be accurate to within 0.1ppm of the received frequency from the base station. And the WCDMA is 2.5ppm. This accuracy is sufficient to meet Sec.24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d)(2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 7VDC and 8.7VDC, with a nominal voltage of 7.6VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. These voltages was varied from 85% to 115%.

A.6.2.2. For equipment powered by primary supply voltage

According to the JTC standard the GSM frequency stability of the carrier shall be accurate to within 0.1ppm of the received frequency from the base station. And the WCDMA is 2.5ppm. This accuracy is sufficient to meet Sec.24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. For this EUT section 2.1055(d)(1) applies. This requires varying primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

A.6.3 Test results

GSM850Mid Channel/fc(MHz) 189/836.4

Frequency Error VS Temperature

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
7.6	-30	2.11	84
7.6	-20	-1.23	84
7.6	-10	0.19	84
7.6	0	-1.22	84
7.6	10	1.12	84
7.6	20	1.32	84
7.6	30	-0.99	84
7.6	40	-1.24	84
7.6	50	1.23	84

Frequency Error VS Voltage

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
7	25	-1.34	84
7.6	25	-1.12	84
8.7	25	0.79	84

PCS1900 Mid Channel/fc(MHz) 661/1880

Frequency Error VS Temperature

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
7.6	-30	-2.12	196
7.6	-20	1.12	196
7.6	-10	2.04	196
7.6	0	1.32	196
7.6	10	-1.84	196
7.6	20	1.71	196
7.6	30	-1.47	196
7.6	40	-2.13	196
7.6	50	-1.36	196

Frequency Error VS Voltage

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
7	25	-1.09	196
7.6	25	1.03	196
8.7	25	-1.63	196

WCDMA BAND II Mid Channel/fc(MHz) 9400 /1880

Frequency Error VS Temperature

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
7.6	-30	-1.33	4700
7.6	-20	-1.1	4700
7.6	-10	-1.11	4700
7.6	0	-0.44	4700
7.6	10	-1.21	4700
7.6	20	-0.53	4700
7.6	30	-0.41	4700
7.6	40	-2.23	4700
7.6	50	-1.71	4700

Frequency Error VS Voltage

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
7	25	-0.6	4700
7.6	25	-1.69	4700
8.7	25	-1.33	4700

WCDMA BAND IV Mid Channel/fc(MHz) 1413/1732.6

Frequency Error VS Temperature

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
7.6	-30	-1.15	4331.5
7.6	-20	-1.33	4331.5
7.6	-10	-0.36	4331.5
7.6	0	-1.63	4331.5
7.6	10	-0.15	4331.5
7.6	20	-0.35	4331.5
7.6	30	-0.95	4331.5
7.6	40	-1.28	4331.5
7.6	50	-1.24	4331.5

Frequency Error VS Voltage

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
7	25	-1.45	4331.5
7.6	25	-2.08	4331.5
8.7	25	-1.05	4331.5

WCDMA BAND V Mid Channel/fc(MHz) 4183/836.6

Frequency Error VS Temperature

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
7.6	-30	-0.14	2091.5
7.6	-20	-0.31	2091.5
7.6	-10	0.96	2091.5
7.6	0	-0.67	2091.5
7.6	10	0.15	2091.5
7.6	20	0.66	2091.5

7.6	30	-0.55	2091.5
7.6	40	-1.08	2091.5
7.6	50	0.29	2091.5

Frequency Error VS Voltage

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
7	25	-0.05	2091.5
7.6	25	0.08	2091.5
8.7	25	0.05	2091.5

Conclusion: PASS

ANNEX A.7. CONDUCTED SPURIOUS EMISSION

A.7.1. GSM Measurement Method and test procedures

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the equipment of PCS1900 band, this equates to a frequency range of 30 MHz to 19.1 GHz, data taken from 30 MHz to 20 GHz. For GSM850, data taken from 30 MHz to 10 GHz.
2. The sweep time is set automatically by instrument itself. That should be the optimal sweep time for the span and the RBW. If the sweep time is too short, that is sweep is too fast, the sweep result is not accurate; If the sweep time is too long, that is sweep is too low, some frequency components may be lost. The instrument will give a optimal sweep time according the selected span and RBW.
3. The procedure to get the conducted spurious emission is as follows:
The trace mode is set to MaxHold to get the highest signal at each frequency;
Wait 25 seconds;Get the result.
4. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

GSM 850 Transmitter

Channel	Frequency(MHz)
128	824.2
189	836.4
251	848.8

PCS 1900 Transmitter

Channel	Frequency(MHz)
512	1850.2
661	1880.0
810	1909.8

A.7.1.1. Measurement Limit

Part 24.238 and Part 22.917 specify that the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

The specification that emissions shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

A.7.1.2. Measurement result

Spurious emission limit -13dBm.

Note: peak above the limit line is the carrier frequency.

A.7.1.2.1. GSM850

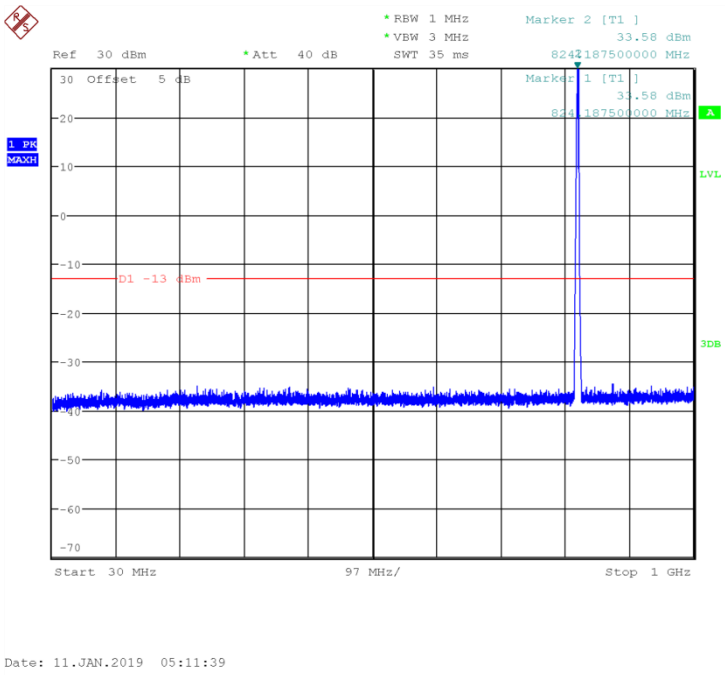

Fig.57 **Channel 128: 30MHz~1GHz**

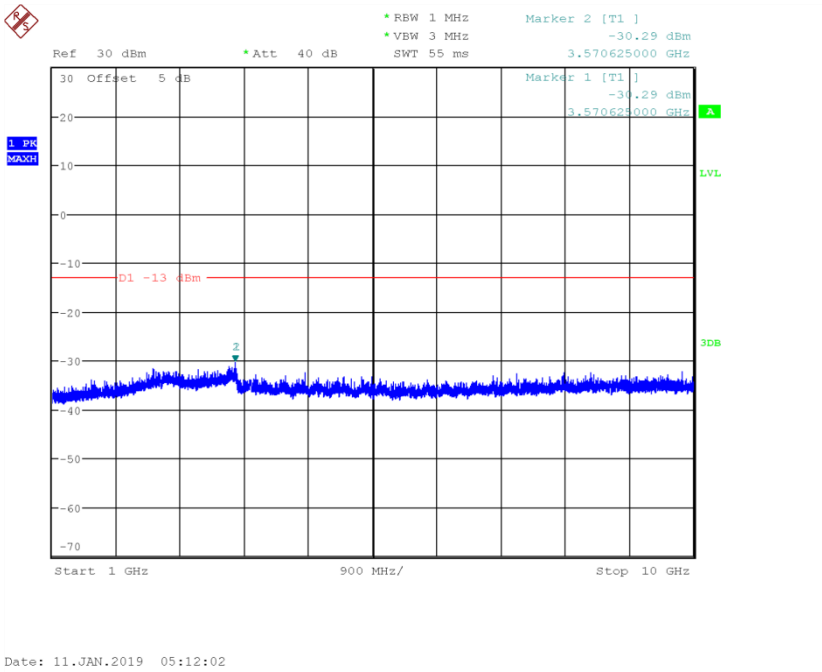

Fig.58 **Channel 128: 1GHz~10GHz**

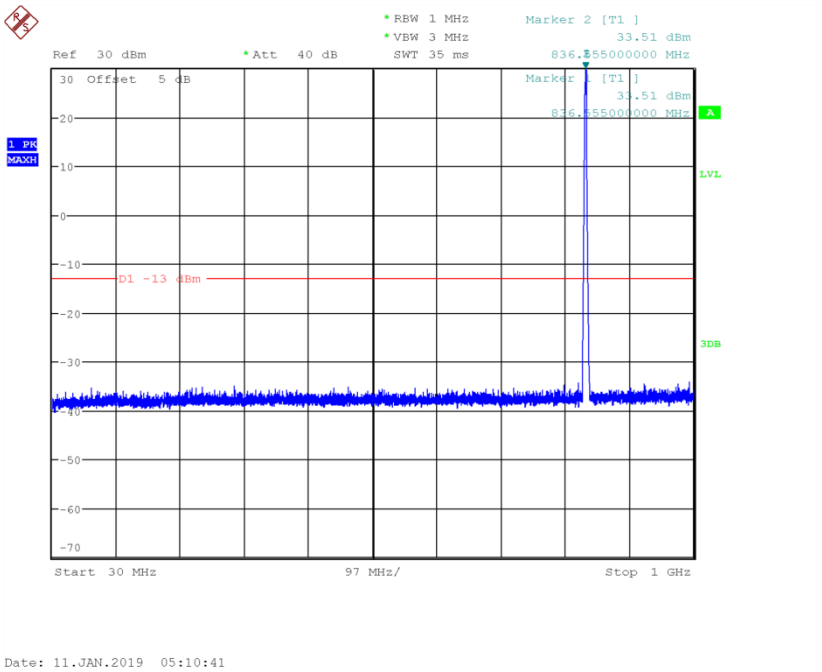

Fig.59 **Channel 189: 30MHz~1GHz**

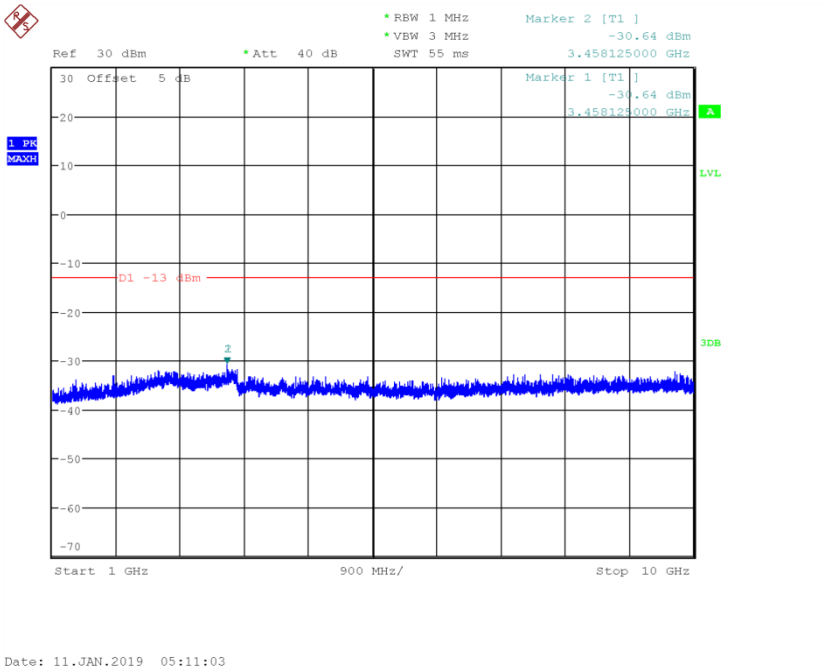

Fig.60 **Channel 189: 1GHz~10GHz**

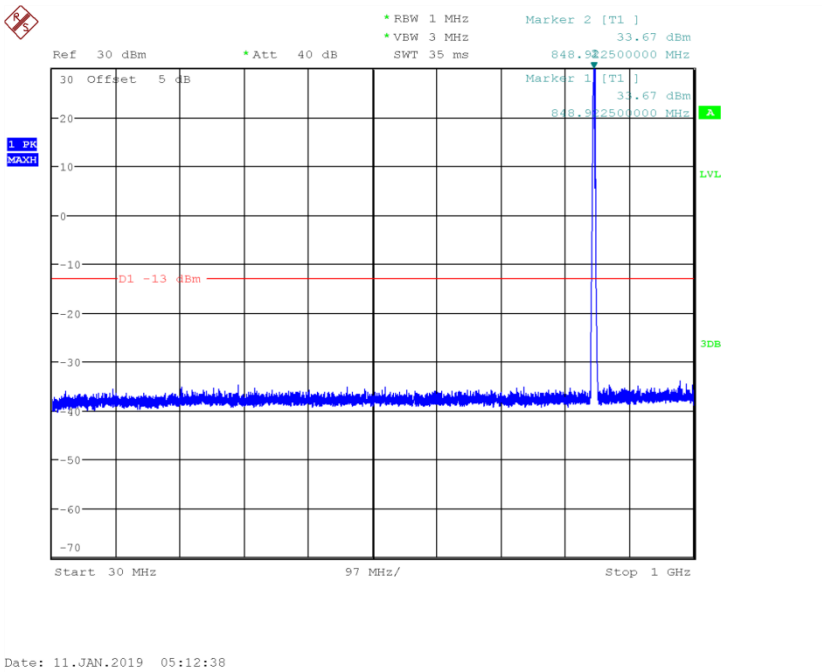

Fig.61 **Channel 251: 30MHz~1GHz**

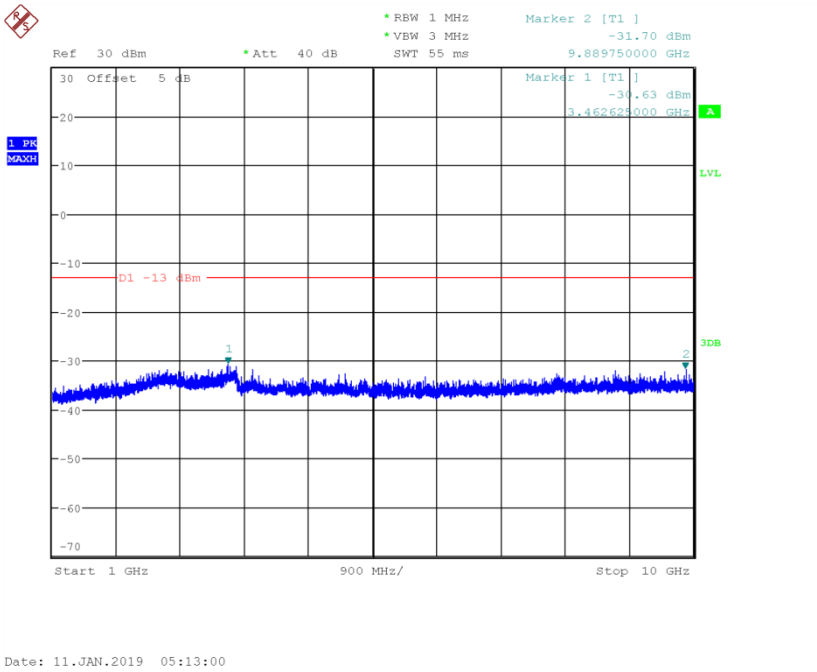

Fig.62 **Channel 251: 1GHz~10GHz**

A.7.1.2.2. PCS1900

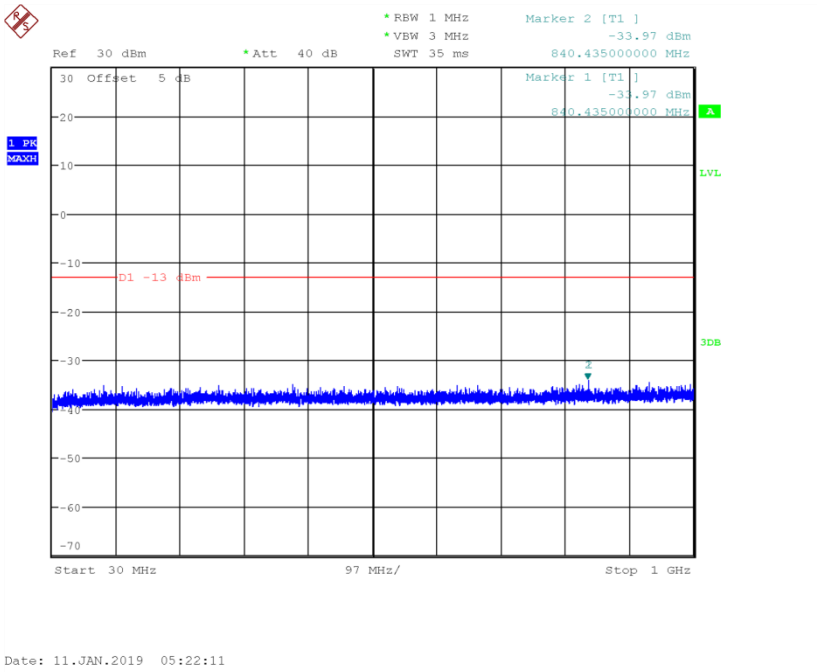

Fig.63 **Channel 512: 30MHz~1GHz**

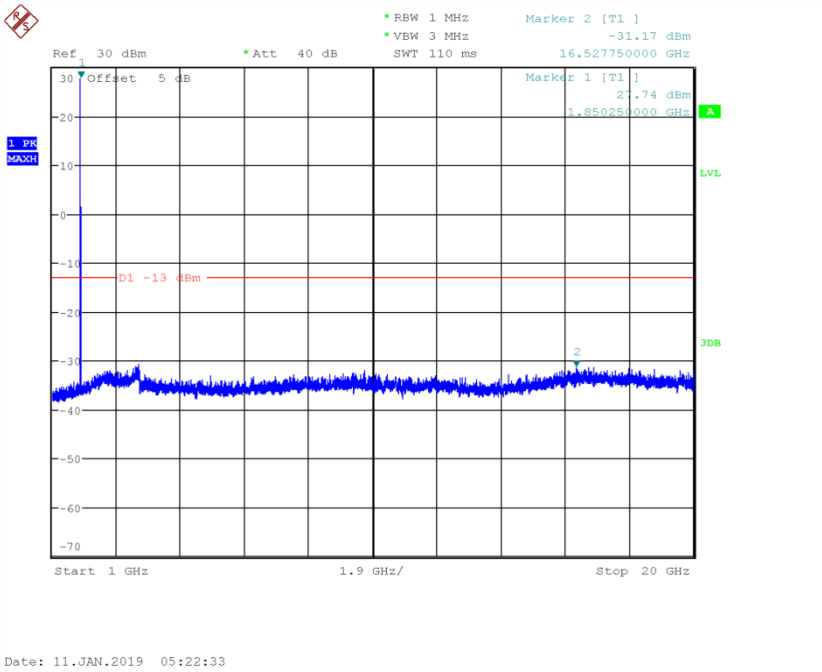

Fig.64 **Channel 512: 1GHz~10GHz**

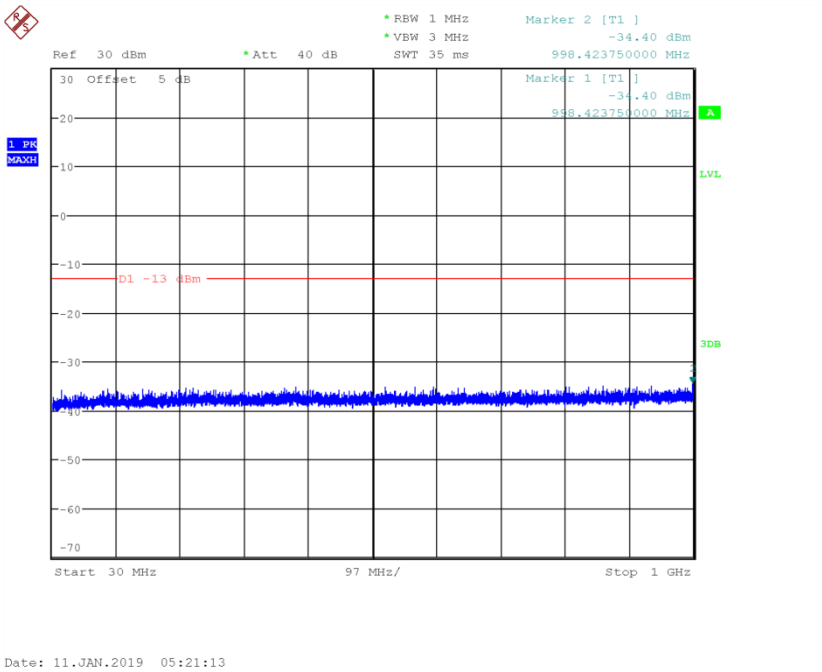

Fig.65 **Channel 661: 30MHz~1GHz**